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(C. C. Morton, M.C., A.C.T.S.M., Chief Government Geologist)

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THE WEST MORETON (IPSWICH) COALFIELD

By

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Geologist.

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The Brisbane River at Riverview near the site of the first colliery in Queensland.

[*Photo.—A. M. McKenzie.*

PREFACE.

★

This comprehensive report is the result of seventeen months' field work in 1943-44 and three weeks in August-September, 1945. The text of the report was submitted on 11th April, 1946, but there was a long delay in the completion of the plans arising out of Mr. Denmead's transfer to Charters Towers in October, 1946, as District Geologist, and it was not until February, 1953, that they were ready for reproduction.

The work was initiated as a means of assisting operating collieries to increase production for war-time requirements. The survey covered an area of approximately 85 square miles and included the inspection and sampling of 31 operative collieries and the examination of more than 100 abandoned adits and shafts. A revision of W. E. Cameron's maps was effected, generally on reconnaissance, but in the vicinity of workings in detail.

This is the first comprehensive report on the field since the late W. E. Cameron's report of 1899 (G.S.Q. Pub. 147). A later report by the same author (G.S.Q. Pub. 204, 1907) dealt particularly with the Bundamba district. Following two years' field work by W. E. Cameron assisted by the late A. C. Reid in 1911-13, geological maps and sections of the field were published in 1923. The text intended to accompany the maps had not been written when Mr. Cameron resigned from the Geological Survey in 1921. Since 1913 there have been a number of specific investigations by Messrs. W. E. Cameron, J. H. Reid, C. C. Morton and L. C. Ball. The reports of these officers, published and unpublished, as well as reports of Inspectors of Mines (notably an excellent historical account of the field by W. Fryar published in 1900) have been drawn on in the preparation of the present report.

The report is divided into two parts; Part I. covering the history, general geology, coal geology, economic products (other than coal) analytical data, production figures, estimates of reserves and a complete bibliography of the Ipswich Coalfield; Part II. detailed local geology, including historical accounts of the various mines. As an appendix there are some petrological notes by Mr. T. H. Connah, M.Sc.

Since the report was written there have been several developments which affect the results of Mr. Denmead's investigations.

Between 1943 and 1948 the Mines Department drilled eight holes in various parts of the field as an aid to prospecting. In 1950, in order to give effect to recommendations by Messrs. Powell Duffryn Technical Services Ltd., the Department began systematic boring to test specified mine areas. By the end of 1952 fifty holes had been drilled and five mine areas had been tested.

One result of the recent drilling has been to show that Mr. Denmead's estimate of inferred reserves (29·55 million tons) was ultra-conservative, as in the Swanbank Lagoon area (Nos. 1, 2 and 3 Mine Areas) and at Bundamba (Nos. 7 and 8 Mine Areas) measured and indicated reserves are now estimated at 46·5 million tons and drilling now in progress near Haighmoor Colliery, North Ipswich (No. 17 Mine Area) will increase measured reserves still further. Arising out of the boring it will also be necessary to make some amendments to the geological map particularly in the vicinity of the old Braeside Colliery at Bundamba.

Reports on the drilled areas will be published from time to time and these may be regarded as supplementing the present report.

C. C. MORTON,
Chief Government Geologist.

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INTRODUCTION.

★

Having been instructed to make an intensive geological survey of the Ipswich and Bundamba productive coalfield I proceeded to Ipswich on 10th May, 1943. The survey was completed on 14th October, 1944. A second visit of three weeks' duration was paid in August-September, 1945. The last survey of the field was made in 1911-1913 by W. E. Cameron.

Area Examined.—The country mapped has an area of approximately 85 square miles, and is enclosed in a square bounded by a north-south line passing through Wulkuraka, a west-east line passing through Loamside, a south-north line passing half-a-mile west of Goodna, and an east-west line passing through Mount Crosby Reservoir. The block thus delineated is ten miles square, but a triangular section of six square miles in the south-west corner and a strip about one mile wide on the east side of the block between the Brisbane River and the southern boundary were not mapped.

Scope of the Survey.—All working pits, thirty-one in number, were examined in as much detail as the condition of the workings permitted. Face samples from one to four in number were taken from each pit, the number of samples being based on the daily output of the colliery.

In addition to working collieries over one hundred abandoned tunnels and shafts were examined, and, where conditions permitted, sampled.

At the same time a revision of the geological map was undertaken. Mapping was done in some detail in the vicinity of existing or abandoned workings. In areas remote from workings reconnaissance mapping only was carried out.

Mapping.—Field mapping was based on (a) the twenty-chain maps published by the Queensland Lands Department; (b) a six-chain map of the City of Ipswich, also published by the Lands Department; (c) the twenty-chain geological map prepared by W. E. Cameron and others and published as Geological Survey of Queensland Publication No. 271; (d) an unpublished geological map of the Dinmore and Bundamba mining areas, on a scale of eight chains to an inch (with 40 ft. contours), prepared by W. E. Cameron and others; (e) an unpublished geological map of the City of Ipswich and the North Ipswich Area, on a scale of eight chains to an inch (with 20 ft. contours), prepared by W. E. Cameron and others. For location of tunnels and shafts, mine plans were used where available.

All roads and numerous stream courses were traversed and a large number of levelled prismatic compass traverses were made in areas where roads either did not exist or could not be located.

Geological Reports.—The following are the chief reports dealing with the West Moreton Coalfield:—

1876—A. C. Gregory: "On the Coal Deposits of the West Moreton and Darling Downs Districts". C. A. Paper. (Not now obtainable, but quoted by R. L. Jack.)

1883—J. E. Tenison-Woods: "The Coal Resources of Queensland", Brisbane 1883 (pamphlet). Quoted by R. L. Jack.

1896—A. Gibb Maitland: Annual Report of Geological Survey of Queensland for 1895 (*G.S.Q. Pub. 108, 1896) pp. 18-23. Includes a map of the field.

1899—W. E. Cameron: "Geology of the West Moreton or Ipswich Coalfield". *G.S.Q. Pub. No. 147.

1900—William Fryar: Annual Report of the Department of Mines, Queensland, for 1899, pp. 156-164.

1907—W. E. Cameron: "The West Moreton (Ipswich) Coal Field, Second Report on (with special reference to the Bundamba District)". *G.S.Q. Pub. No. 204.

1913—W. E. Cameron: "The Ipswich Coalfield. Pretertiary Denudation and its Effect on the Continuation of the Seams". †Q.G.M.J., August 1913, p. 412.

1920—W. E. Cameron: "Palmer's Property, Bundamba District. Prospecting of the Aberdare Seam Beyond the Present Worked Area". †Q.G.M.J., November 1924, p. 411.

1922—J. H. Reid and C. C. Morton: "Contributions to the Geology of Ipswich". †Q.G.M.J., September 1922, p. 355; October 1922, p. 390.

1923—W. E. Cameron: *G.S.Q. Pub. 271. A detailed geological survey of the field was conducted by the late W. E. Cameron from 23rd November, 1911, to 19th December, 1913. As a result of this work and some subsequent inspections two geological maps, accompanied by geological sections, were published in 1923 as *G.S.Q. Pub. 271. No explanation of these maps, except perhaps Mr. Cameron's notes appearing in the Annual Reports of the Geological Survey for the years 1911, 1912, 1913, has been published, nor, so far as is known, is in existence. Numerous sections of coal seams, bores, and shafts, presumably prepared by Mr. Cameron at this time, are among the records in the Geological Survey Office, and these have been extensively used in the preparation of this report.

1926—O. A. Jones: "The Tertiary Deposits of the Moreton District", Proc. Roy. Soc. Q'ld., vol. XXXVIII, 1926, pp. 23-46.

1930—D. Hill: "The Stratigraphical Relationship of the Shales about Esk to the Sediments of the Ipswich Basin", Proc. Roy. Soc. Q'ld., vol. XLI, 1930, pp. 162-190.

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* "Geological Survey of Queensland."

† "Queensland Government Mining Journal."

A full bibliography of the Ipswich field will be found at the end of the report (see page 94).

Acknowledgments.—During the whole of the survey I was assisted by Mr. C. L. A. Brown, formerly a coal miner of Ipswich, with complete satisfaction, and I should like to pay a particular tribute to Mr. Brown for his readiness to undertake the often difficult and usually dangerous task of pioneering a way into old abandoned tunnels, most of which I could not otherwise have seen.

I am indebteded to all directors, mine managers and deputies for their assistance which was always freely given. To Mr. J. Conway, Superintendent of Aberdare Collieries, I extend my sincere thanks for unreservededly placing at my disposal his vast knowledge of the Ipswich field as well as all his field maps and sections; and to the late Mr. A. Wright who, though in poor health, escorted me over portions of the field with which he was particularly familiar and gave me the benefit of his detailed knowledge of those areas. To Messrs. T. Sharp and J. Haggerty, Inspectors of Collieries, I owe my gratitude for numerous acts of helpfulness.

SUMMARY.

The Ipswich Coalfield, which this year (1946) celebrates its centenary, lies approximately 20 miles westerly from the port of Brisbane with which it is connected by rail. There are thirty-one working and about eighty abandoned collieries on the field. The collieries are scattered over an area of 60 square miles, though the great majority of them are concentrated in the two main mining districts of Bundamba-Dinmore (12 square miles) and Tivoli (3 square miles). Coal production to date totals 28 million tons.

Geological formations of Tertiary, Mesozoic, and lower Palaeozoic age are met with on the field. The Tertiary rocks comprise basaltic lavas and tuffs, magnesian limestones, soft clays and sandstones, black fissile shales and coarse conglomerates. The Mesozoic rocks belong to three distinct series—the Walloon Series of Jurassic age which are found only on the extreme west of the field; the Bundamba Series (Upper Triassic) which lies unconformably under the Walloon Series and is predominantly arenaceous; the Ipswich Series (Middle to Upper Triassic), consisting of shale and sandstone with subordinate ironstone and beds of lava and tuff towards the base. The Walloon Series carries coal seams though not in the area covered by the report. The Bundamba Series carries a number of thin coal seams towards the base one of which has been worked to a small extent. The Ipswich Series includes twenty-four worked seams and a large number of other seams which are too small or too inferior to work. Between the Bundamba Series and the Ipswich Series there is a pronounced non-sequence.

The Ipswich coal measures have a general dip to the south or south-south-east but they are also folded about north-north-west and south-south-east axes. The most important structure is the Bundamba anticline along the flanks of which most of the pits are disposed.

Faulting is prevalent throughout the field, the dominant strike of the major faults being north-west and south-east. A large number of dykes have been met with in underground workings but the destruction of coal due to this agency is trifling.

According to the classification adopted by the American Society for Testing Materials, the Ipswich coal lies in the medium-volatile, bituminous group.

Total reserves of coal are conservatively estimated at 37,750,000 tons. Average ash content based on proximate analyses of samples taken by the writer is 18·7 per cent. With the approaching exhaustion of the Aberdare and Four Foot seams and the more extensive exploitation of the banded coals the average ash content is likely to show an upward trend in the next few years. Beneficiation which is now practised in only a few of the pits is expected to become more general. As to utilisation approximately one-third of the field's output is absorbed by electrical generating plants, other important consumers being railways (19 per cent.) and gas (15 per cent.).

PART I.—HISTORY, GENERAL GEOLOGY, ETC.

CHAPTER 1.

HISTORY OF THE FIELD.

Coal was found in the vicinity of Ipswich by Captain Logan in 1827. W. Fryar (1900) records that commercial working of coal commenced at Redbank in 1846. The Redbank Colliery was abandoned after two years in favour of the Moggill Pit, which worked continuously for fourteen to fifteen years. In the meantime Redbank Colliery had been re-opened (in 1857) and worked for a number of years. The first colliery in North Ipswich was opened by Walter Gray in 1854. (I have not been able to identify this pit.)

The Aberdare Seam was discovered about the year 1870. The coal was superior to any coal previously worked, and, in addition, owing to the flatness of the seam and its outcropping on the side of a gorge, it was very cheaply mined; and it is not surprising to learn that a number of smaller pits in the district were forced to close for lack of a market for their relatively inferior and high-priced products. The extension of the Aberdare Seam was subsequently traced to the south-east, and by the end of the century half-a-dozen collieries had sprung up along the outcrop for a distance of two miles. Later development in this district took the form of deep sinking for the Aberdare Seam, which reached its zenith with the sinking of the New Aberdare Shaft to intersect the seam at a depth of 836 ft.

In the meantime the New Chum (Four Foot) Seam had been discovered at Dinmore, with the result that two major collieries, Gulland's (New Chum) and Stafford's (Whitwood), were opened up. These two pits are still working, though the original seam is long since exhausted. The outcrop of the New Chum Seam was later found further south and new collieries were established at Rhondda, Noblevale No. 1, Sunrise (Bonnie Dundee No. 2), and elsewhere.

In the North Ipswich district large-scale mining commenced about 1870 with the opening up of the Waterstown (later known as the Abermain) Colliery. By the end of the century there were half-a-dozen flourishing pits in the district, most of them equipped with coke ovens, for it had been established that the North Ipswich coals produced a good coke. This once important mining district now produces no more than seven per cent. of the field's coal, but has lately begun a revival which promises to assume quite useful proportions.

With the exhaustion of the New Chum Seam at Dinmore the lower, banded coals began to come into prominence, and they are now the mainstay of mining in that district, their relative inferiority being to some extent offset by their greater thickness. In the Bundamba district the Aberdare Seam is now largely worked out. The lower seams here have still to be proved, though in the early days of the field they were all exploited to a small extent near the outcrop. In the southern part of the district the Bluff Seam has lately begun to assume importance because of the large reserves of medium-grade coal. It possesses one important advantage over the Aberdare Seam—it is not subject to spontaneous combustion to anything like the same extent.

Though fluctuating in sympathy with the industrial prosperity of the country, the output of the field showed a progressive increase from the year 1860 (the first recorded production), until 1910, when the output of the field was 665,000 tons (including the Rosewood-Walloon district); but from that year until the present time it has been virtually static, having risen as high as 760,000 tons and fallen (during the depression years of 1931 to 1935) below 500,000 tons. During the war years the output has risen appreciably until in 1945 it reached an all-time record of 812,640 tons.

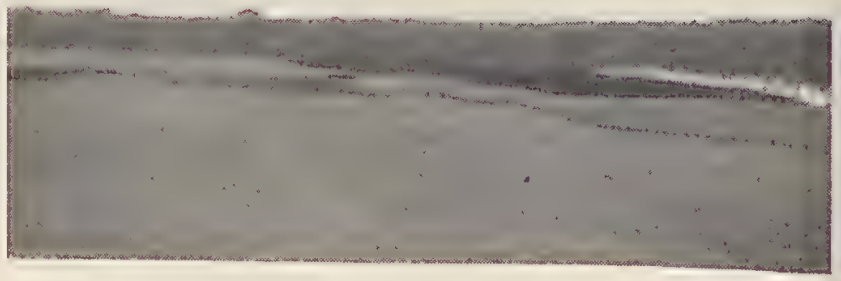
CHAPTER 2.
GEOLOGICAL SUCCESSION.

The Ipswich area includes geological formations ranging from early Palaeozoic (? Silurian) to late Tertiary. These are shown in descending order in the annexed table. (Table 1.)

Tertiary.

Black fissile shales and soft felspathic sandstones of "presumably Cretaceous" age were described by W. E. Cameron in his second report (1907) from the Redbank Plains district lying unconformably on Bundamba Grits. In the same report, under the heading "Basaltic and Felsitic Lava Flows," it is stated that the occurrence of several large areas and a few isolated patches of these rocks seem to indicate a once almost continuous extension over the whole area. The volcanic rocks of Redbank Plains were thought to be "more of the nature of andesite or trachyte," and were shown on the map as "felsitic lavas."

In the geological column accompanying the 20-chain map of 1923, Mr. Cameron divided the Tertiary rocks into a lower series—the Redbank Plains Series—and an upper series—the Silkstone Series—having in the meantime (Cameron 1913) recorded the existence of Tertiary mudstones and soft argillaceous sandstones, interstratified in their upper part with basalt and lying unconformably on the Coal Measures in the area between Dinmore and Ipswich. He included in his Silkstone Series, clays, fissile shales, dolomitic limestone, and interbedded basalts, with a total thickness of 400 ft., while the Redbank Plains Series comprised 500 ft. of vesicular basalt overlying 300 ft. of fissile shales and sandstones. No trachytic or andesitic rocks were included.



FARM LANDS, NORTH BUNDAMBA.

Note fertility of Tertiary country (foreground) by contrast with the forested coal-measure ridges in the background beyond the Bremer River. Irrigation sprays on right.

[*Photo.—A. M. McKenzie.*

O. A. Jones (1926) described the Redbank Plains Series as consisting of sandstones, clays, and fissile shale, containing the remains of fish, dicotyledonous leaves, wood, and insects, with overlying basalt and spherulitic trachyte. He placed the age of the Redbank Plains Series as Eocene or Oligocene and of the Silkstone Series as Upper Tertiary.

TABLE 1.—GEOLOGICAL FORMATIONS REPRESENTED ON IPSWICH COALFIELD.

Series.			Thickness.	Constituent Rocks.
			ft.	
Tertiary	.. Redbank Plains		1,000	Conglomerate, shale (including low-grade kerosene shale), clay, soft sandstone, basaltic lavas, tuff, magnesian limestone
Mesozoic	.. Walloon (Jurassic)	Upper or Rosewood Stage	1,000 +	Felspathic sandstone and clay shale, with beds of calcareous shale and sandstone and numerous coal seams
		Lower* or Marburg Stage	700 +	Mainly felspathic sandstone, beds of clay shale
	.. Bundamba (Upper Triassic)		? 1,600	Soft sandstone, hard gritty sandstone, silicious sandstone, conglomerate, sandy shale, shale, several small coal seams
	Ipswich (Middle to Upper Triassic)		4,140	Shale, sandstone, conglomerate, acid tuff, basic lava, thin limestone, numerous coal seams
Palaeozoic	.. Brisbane Metamorphics (? Silurian)		..	In this area chiefly jasperoid and other silicious rocks, with some basic tuffs

* No representative on the field.

The writer has seen a detailed section of part of the Tertiary succession as revealed by a diamond drillhole in portion 132, Ipswich (Cribb Estate). This showed 120 ft. of yellow clay shale, green earth, and low-grade oil shale succeeded by basaltic lava, tuff, and agglomerate, green and red earth with interbedded magnesian limestone. Shale and mudstone were passed through from 770 ft. to 913 ft.

Three distinct bands of magnesian limestone were penetrated, the first between 204 ft. and 252 ft. interbedded with red and green earth and basalt; the second between 290 ft. and 325 ft. (merging into pink and green earths); and the third 388 ft. and 403 ft. (merging into basalt and pink and green earths). The stratigraphic range of the magnesian limestone beds is estimated to be 188 ft.

In no case is there a sharp division between basalt and limestone. Usually the basalt becomes highly vesicular, then agglomeratic and earthy, and the percentage of carbonate increases gradually. Much of the limestone exhibits a faint brecciation.

The magnesian limestone bands are considered to have been formed sub-aqueously in heavily mineralised waters into which volcanic material, chiefly ash, was being, or had recently been, discharged. Animal life is hardly likely to have flourished under such conditions and the limestones are generally devoid of fossils. A number of specimens of a small species of *Planorbis**, however, have been found in one of the limestone outcrops in Queen's Park (*see* Jones, 1926), indicating at least one considerable lull in volcanic activity. In Queen's Park and elsewhere the limestone is irregularly traversed by veins of chalcedonic silica. The very slight silicification of the limestone in the borehole suggests that the phenomenon is largely superficial.

From highest to lowest, the basalt is of a similar type, and, in my opinion, belongs to one more or less continuous period of volcanic activity. Furthermore the sediments above, below, and interstratified† with the basalt are very similar. It seems that there was continuous deposition in the Silkstone Basin, and I can see no justification for Mr. Cameron's division into an upper and a lower series. I propose, therefore, to include all the Tertiary rocks about Ipswich in the Redbank Plains Series. The "Silkstone Series" automatically lapses.

Two small patches of basalt have been mapped in the Dinmore district, one in portions 269 and 270, Goodna, and on the road between those portions, and the other in portion 220, Goodna, near Whitwood No. 4 Shaft. The former underlies fossiliferous Tertiary shales. Lithologically identical shales are quarried in portion 260. They are closely packed with impressions of dicotyledonous leaves. Insect wings and fish remains are also reported to have been found here. The basalt in portion 220 has been much affected by pneumatolytic agencies and contains numerous inclusions of calcite and chalcedony and green jasperoid, the last two often occurring as small outcropping masses.

The trachyte mass, constituting the bulk of Mount Juillerat in portions 168 and 188, Bundamba, rises abruptly from undulating black soil country. Black fissile shale, which occurs within a few feet of the edge of the trachyte, shows no sign of metamorphism. The occurrence suggests that the trachyte is older than the Tertiary shales, but its relationship to the Ipswich Coal Measures is unknown.

Coarse gravel strongly cemented at the base occurs as cappings at Jones' Hill, Dinmore (portions 214, 263, Goodna), Moggill (portions 156, 157), and elsewhere. At Jones' Hill the gravel rests on the inclined and denuded Ipswich beds at an elevation of 350 ft. above sea level, indicating a very considerable uplift since the time of their deposition. At Moggill the gravels are associated with shales and sandstones of Tertiary aspect. Gravel or conglomerate beds have been recorded from the base of the Redbank Plains Series in Aberdare Extended No. 2 diamond drill-hole.

The gravel cappings are not co-extensive with the Redbank Plains beds, and their occurrence rather suggests that they may be a late phase of Tertiary sedimentation.

To the west of Ipswich, where the Pine Mountain Road joins the Toowoomba Road, Mr. Cameron's twenty-chain map (1923) shows a patch of Tertiary with a small basalt occurrence at its north-western extremity. In the smaller-scale map (one mile to an inch) this is marked "Mesozoic", and no basalt is shown. The southern part of the area (portions 462, 465, 489, Brassall) is covered with loose gravel, and the entrenched watercourses show eight feet of horizontally disposed conglomerate, sandstone, and indurated ferruginous clay, underlying which there are folded Ipswich shales and conglomerates. Further north these give place to black soil similar in all respects to that seen at Redbank Plains. Reid and Morton (1922, pp. 358, 391) deleted all of Cameron's Tertiary areas to the west-north-west of Ipswich and placed them as Ipswich basal conglomerates. Some of these areas may be of Tertiary age, as in one or two cases they are associated with basalt; but the possibility that the majority of them may be outliers of Walloon beds cannot be entirely ruled out.

The age of the Redbank Plains Series has been put (tentatively in each case) as Eocene or Oligocene, on general grounds by O. A. Jones (1926); as "Lower Miocene, or even older, to Pliocene on the evidence of some ostracods occurring therein" by F. Chapman (1934); and as "Oligocene" by E. S. Hills (1934), after a study of the fish remains.

From an economic point of view the Tertiary beds are mainly of significance in that large quantities of valuable coal have been eroded away in some of the areas which they now occupy, *e.g.*, the Aberdare Seam at Bundamba and the Four Foot Seam at Dinmore. The basalt about Bundamba has been extensively quarried for road metal and the clay-shale beds at Dinmore are worked for pottery clay. Surface gravels derived from Tertiary conglomerates are gathered for filling and for road material. In the early days of Ipswich the limestone in Queen's Park was burned for lime. The outcropping limestone from various localities was also used in the manufacture of cement (A. Gibb Maitland, 1896).

* A small fresh-water gasteropod.

† A thin lenticular bed of jet-black highly fissile shale with fish-scale impressions occurs sandwiched between basalt flows in Robertson Street, between Whitehill Road and Chermside Road at East Ipswich. It has frequently been mistaken for a coal crop.

WALLOON SERIES.

The Walloon beds occur mainly to the west of the area surveyed, and my examination of them was only incidental. They comprise "mainly soft, very felspathic sandstones with clay shales, but [the] formation [is] characterised by thin beds of fossiliferous red sandstone, ironstone concretions, numerous beds of calcareous shales and sandstones and numerous coal seams. *Cladophlebis, Taeniopteris, Sphenopteris,* etc., abundant". (J. H. Reid, 1922.) The Walloon country traversed by the writer was flat to gently undulating and outcrops were rare. The thickness of the series in the Marburg-Rosewood district is estimated by Reid to be 1,100+ ft. It is considered probable that some of Cameron's "Tertiary" areas immediately west of Ipswich may be outliers and/or marginal areas of Walloon beds.

Relation of Bundamba and Walloon Series.

W. E. Cameron (1907 and 1923) concluded that the Bundamba Sandstones underlay the Walloon Series conformably. He explained the juxtaposition of steeply dipping Bundamba beds and sub-horizontal Walloon beds as due to monoclinal folding, pointing out that at Churchill, to the south of Ipswich, the Walloon beds dip steeply in apparent conformity with the older Bundamba Sandstones.

J. H. Reid (1922) stated that the lower or Marburg Sandstone Stage of the Walloon Series rested unconformably on the folded Mesozoic rocks of the Brisbane Valley. Subsequently Reid and Morton (1922) expressed the view that the folded Mesozoic rocks of the Brisbane Valley were unconformably related not only to the Walloon Series to the west but also to the Ipswich Series to the east. This view they later (Reid and Morton, 1924) retracted after viewing steeply-dipping Walloon beds in line with the Brisbane Valley disturbance in the vicinity of Mount Flinders, south of Ipswich. They concluded that "the almost absolute flatness of the Walloon Series and certain beds of the Bundamba Series [Marburg Stage—A.K.D.] from Wulkuraka for some miles northwards along the edge of the steeply folded rocks, must connote further faulting or abnormally sharp folds in them and not unconformability."

Miss D. Hill (1931) was puzzled by the juxtaposition of sub-horizontal Marburg Sandstones and vertical beds of the Acid Tuff Stage of the Upper Esk Series in the Fernvale-Fairney View area, some miles north-west of Ipswich. Of the two possible explanations of this phenomenon, *viz.*—1. an unconformity; and 2. a fault with a downthrow to the south-west, she favoured the latter. If such a fault existed and if there were no unconformability, the Marburg beds would have been thrown down some two thousand feet without any tilting, which, to say the least, is extremely unlikely.

While the junction between the sub-horizontal Walloon (or Marburg) beds and the steeply dipping beds is roughly linear for some fifteen miles, the latter become progressively older (from Bundamba to Esk in age) going north-north-west from Ipswich. Moreover, the junction, as mapped by Cameron and others, is quite irregular in detail.

There thus seems no alternative but to accept the unconformability of the Walloon Series and the Ipswich (and Bundamba) Series. Even though the steeply dipping Walloon beds at Churchill and further south lie in the zone of the pre-Walloon disturbance, there seems no reason why the tilting there could not have occurred in Tertiary times, seeing that Tertiary beds are sharply folded or faulted along lines parallel with and quite close to the West Ipswich Fault, as at Limestone Hill.

BUNDAMBA SERIES.

W. E. Cameron (1907) used the term "Bundamba Beds" to describe the "coarse grits and sandstones with thin interbedded finer strata," whose base, consisting of coarse grits and conglomerates, lies 70 ft. above the Aberdare Seam at Blackstone.

It is now proposed to divide the Bundamba Series into two stages, a lower or Aberdare Conglomerate Stage, and an upper or Bundamba Sandstone Stage.

Aberdare Conglomerate Stage.

On the 1923 map Cameron has differentiated the Aberdare Conglomerate from the Bundamba Sandstone by giving it a different colour, though in the geological column accompanying the map he did not distinguish it by a special stage or serial name. The term "Aberdare Conglomerate" was used first by Reid and Morton (1922) and later by Whitehouse (1930). The Aberdare Conglomerate is rather variable as to composition and thickness. At Blackstone Hill, which may be regarded as the type-locality, the Aberdare Conglomerate Stage is made

Panoramic view from Blackstone Hill. Wooded country of Sediments and Basalt. Mountains in right background, with resistant Aberdare Conglomerate.

up of silicious pebbly conglomerate and silicious sandstone with interbedded shale, much of which is carbonaceous. The thickness of the stage here is about 120 ft. The big spread of outcropping conglomerate on Blackstone Hill is due to the unusually low dips prevailing there, the resistant conglomerate occupying the dip slope.

Following the horizon of the Aberdare Conglomerate south-east from Blackstone Hill the conglomerate rapidly thins out, and disappears entirely in the vicinity of old *Fairbank Tunnel* in portions 294, 295, Goodna. On Bogside Hill (portion 197, sub. 3, Goodna) and further south in portion 18, Bundamba, the stage is represented by coarse to fine silicious sandstone and interbedded shale, but conglomerate reappears in portions 17 and 13, Bundamba. At *Palmer's Aberdare Colliery* in portion 98, Bundamba, a silicious conglomerate indistinguishable from the Aberdare Conglomerate immediately overlies, and, in places, fills erosion channels in the Bluff Seam. At old *Bonnie Dundee* and *Blackheath Collieries* on the eastern limb of the Bundamba Anticline only thin beds of conglomerate occur interbedded with sandstone.

South of old *Bonnie Dundee* the Aberdare Conglomerate is overlain by a succession of beds of more or less highly silicified sandstone separated by thin shale sections. These beds, which are estimated to have a thickness of 700 ft. or more, were included by W. E. Cameron in the Aberdare Conglomerate Stage; but they are now placed in the Bundamba Sandstone Stage.

In *Rhondda* and *Noblevale No.* 1 *Collieries* the Bluff Seam is immediately succeeded by beds of silicious sandstone with thin interbedded shales similar to the strata overlying the Aberdare Conglomerate south of old *Bonnie Dundee.* The silicious sandstones and associated shales plunge beneath the alluvium of Six-Mile Creek at the northern end of *Rhondda Colliery,* to reappear in portion 285, where they are strongly folded into a closed structure. A narrow belt of silicious sandstone can be traced into portion 61; but approaching Redbank the silicious sandstone is replaced by coarse massive sandstone. The Aberdare Conglomerate really loses its identity about *Rhondda Colliery,* and cannot be traced for certain east of that locality.

About Denmark Hill the Aberdare Conglomerate is more definitely conglomeratic than elsewhere on the field; but nevertheless it includes coarse sandstone and shale and even thin coal seams, the crops of which may be seen in the Ipswich City Council's Quarry in R.839. The thickness of the stage here is 250 to 300 ft.

In the zone of the West Ipswich Fault the Aberdare Conglomerate is well exposed in an old quarry in R.836 near the Thomas Street Railway Station. In lithology the beds here are identical with those seen at Denmark Hill. The stage can be traced almost continuously to portion 489, Brassall (the limit of my observations in this direction). As mapped by me in this area, the Aberdare Conglomerate Stage is very much wider than is indicated on Mr. Cameron's map (1923). Where crossed by the Toowoomba Road the stage has, according to my estimate, an apparent thickness of 500 ft. or more.

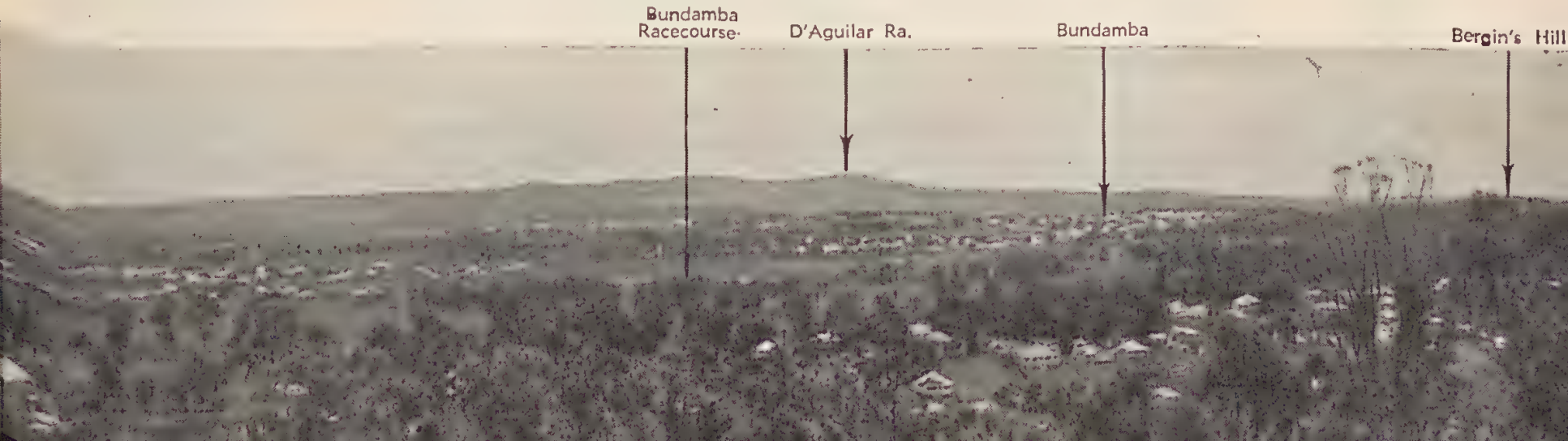
Bundamba Sandstone Stage.

The Aberdare Conglomerate grades upwards into a succession of shales and sandstones which carry a number of thin coal seams, one of which, the Little West Moreton, has been worked in the vicinity of Blackstone. Fossils found in the shales associated with the Little West Moreton Seam—*Thinnfeldia odontopteroides, T. feismanteli, Ginkgo* sp., *Cladophlebis australis*—are typical Ipswich forms.

Above the coal-bearing section, which is about 300 ft. thick, the Series is made up of massive sandstones with thin beds of sandy shale. The Bundamba Series generally produces a loose, light-coloured sandy soil that is usually poor but in places, as in the valley of Bundamba Creek, makes fair to good pasture-land. The sandstone has been quarried for road metal and, to a small extent, for building purposes. The Aberdare Conglomerate has been extensively quarried for road metal, &c.

RELATION OF BUNDAMBA AND IPSWICH SERIES.

The existence of a fairly widespread conglomerate at the base of the Bundamba Series is taken to indicate a period of non-deposition shortly after the laying down of the Aberdare Seam. The erosion of the Ipswich beds prior to the commencement of the Bundamba period shows that there must have been a general elevation at the close of the Ipswich period. The elevation, however, does not appear to have greatly exceeded 100 ft.; and the strict



a Coal Measures. Cleared country middle distance, Tertiary orphics (The D'Aguilar Horst). Blackstone Hill itself is capped

[*Photo.—A. M. McKenzie.*

TABLE 2.

PROPOSED SUBDIVISION OF THE BUNDAMBA AND IPSWICH SERIES.

					Thickness.
Bundamba Series (Upper Triassic)	Bundamba Sandstone Stage			Sandstone and a little sandy shale	1,200′
				Little West Moreton Seam	1′ 10″
				Shales and sandstones with thin coal seams	300′
	Aberdare Conglomerate Stage			Conglomerates, shales and siliceous sandstone with thin coal seams	50–300′ (Av. 150′)
	Short Erosion Period.				
Ipswich Series (Middle to Upper Triassic)	Blackstone Stage	Aberdare Shales		Shales with numerous coal bands towards the base and one workable lenticular seam (the New Found Out)	0–150′ (Av. 50′)
				Aberdare Seam	Av. 13′
				Shales with thin coal bands	Av. 100′
				Bluff Seam	Av. 28′
				Shales, including one workable seam in the southern part of the field	50–220′
		Four Foot Sandstone			0–65′ (Av. 30′)
		Rhondda Shales		Shales	0–100′
				Four Foot Seam: Top Coal; Coal & stone bands; Main seam	22′
				Shale and lenticular sandstone	1′ 6″–90′
				Bergin's Seam	Av. 6′ 6″
				Shale, sandy in part	60′
				Striped Bacon Seam	Av. 5′ 3″
				Shale, sandy in part	45′
				Rob Roy Seam (? Braeside No. 1 Seam)	Av. 6′ 3″
	Cooneana Stage			Chiefly shales	75′
				Braeside No. 2 Seam	3′ 6″
				Shales	40′
				Braeside No. 3 Seam	3′
				Shale and lenticular coarse sandstone	140′
				Braeside No. 4 Seam	3′ 6″
				Shale, lenticular coarse sandstone and several thin coal seams	550′
	Tivoli Stage	Abermain Beds	Productive	Garden Seam	3′ 6″
				Shale	100′
				Tantivy Seam	3′ 4″
				Coarse sandstone and shale	230′
				Fiery Seam	23′
				Shale and sandstone	50′
				Waterstown Seam	3′
				Coarse sandstone and a little shale; Unnamed seam (lenticular); Shale and sandstone	230′
				Tivoli Seam	4′ 9″
				Shale and sandstone; Poverty Seam (lenticular); Shale	30–100′ Av. 80′
				Eclipse Seam	5′ 9″
				Shale; Francis' Seam (lenticular); Shale and coarse lenticular sandstone	300′
				Benley Seam	10′ 2″
				Chuwar Shales. Shales with numerous thin coal beds and two large banded seams (including Waterworks Seam)	550′
	Kholo Stage			"White Conglomerate"	60′
				Tuff Beds	120′
				Kholo Conglomerate	800′
				Mount Crosby Insect Shales (including rhyolitic tuff, calcareous sandstone and conglomerate	80′
				Andesite and andesitic tuff	0–150′

angular conformity between the two formations proves that there was no folding or heavy faulting during the period of non-deposition. It is believed that this period was comparatively short, because the sediments above the Aberdare Conglomerate bear a close similarity to those below it; the contained fossils are similar; and the coals are identical in character. By contrast, the Walloon beds present an entirely new lithology, a different suite of fossils, only two genera (*Cladophlebis* and *Sphenopteris*) being common to the two formations, and an altogether different type of coal.

IPSWICH SERIES.

General Statement.

The Ipswich Series is made up of a succession of freshwater sediments with some volcanic rocks towards the base. Shales and sandstones constitute the bulk of the deposits but ironstone is of fairly widespread occurrence, and nodular limestone and calcareous rocks of very limited extent and thickness occur in the lower part. A characteristic feature of the series throughout is the high degree of lenticularity of the beds and particularly of the sandstones. In the eastern part of the field sandstone increases at the expense of the other beds, many of which disappear altogether. The total estimated thickness of the series, not including the basal andesite, is 4,080 ft.

The beds have a general southerly to south-south-easterly dip, but there are important folds with north-south to north-north-west—south-south-east axes. Faulting is prevalent throughout the field. Dykes of basic composition are numerous, but they rarely spread along the coal seams.

The Ipswich Series carries a rich fossil flora thought to be indicative of an Upper Triassic (Rhaetic) age. There are also two prolific fossil insect horizons.

Twenty-four coal seams have been worked. The coals are medium-volatile bituminous coals. The coal is characteristically bright, the proportion of splint rarely exceeding one-quarter. The quantity of mineral matter* other than shale bands in the majority of the seams is rather high (more than 10 per cent.).

Sub-divisions of the Ipswich Series.

In his first report Cameron (1899) recognised two divisions of the Ipswich Series as follows:

The Coal-bearing Beds.
The Basal Conglomerate.

In the second report (Cameron, 1907) which referred chiefly to the Bundamba and Dinmore districts it was stated that the mapping of the field had disclosed that the North Ipswich seams were on a lower horizon than the beds about Bundamba. The beds of the Bundamba district were sub-divided as follows:—

Bundamba Beds.
Aberdare Shales.
Four Foot Sandstone.
Bundamba Shales.
Cooneana Sandstone.

The geological column accompanying the map of 1923 shows:—

Bundamba Series.
Conglomerate.
Ipswich Series.

The "Conglomerate" as mapped by Cameron had previously been shown on a published map by Reid and Morton (1922) under the name of "Aberdare Conglomerate".

* Usually spoken of as "inherent ash."

N. J. de Jersey (1944) states that the coals of the Ipswich field are divisible into two groups corresponding with two distinct stratigraphical stages:—

Upper Coal Seams of the Bundamba District (Blackstone Stage).
Lower North Ipswich Seams (Tivoli Stage).

Mr. de Jersey did not indicate the limits of the stages nor the features (apart from the coals) which distinguished one from the other.

The sub-divisions of the Ipswich Series now proposed are shown in Table 2.

The Kholo Stage.

Included in the Kholo Stage are all the beds underlying the Waterworks Seam. These rocks outcrop on the banks of the Brisbane River between the Old Ipswich Waterworks and Moggill. There are four clearly defined sections in this stage.

The Basal Andesite.—Lying immediately on the basement rocks, the Brisbane Metamorphics, there is to be seen at intervals between Sahl's Pocket and Moggill a somewhat altered and sometimes vesicular andesite or andesitic basalt. The andesite is often absent and the Mount Crosby insect shale or the Kholo Conglomerate rests directly on the metamorphics. With the andesite at Mount Crosby old weir there is associated a thin bed of andesitic tuff. The Basal Andesite is believed to belong to Miss Hill's "Acid Tuff" Stage of the Esk Series (D. Hill, 1931).

The biggest development of andesite is in the north-western part of the parish of Moggill. The rock crops out on the bank of the Brisbane River and has been extensively quarried for road metal in portions 174 and 175, Moggill. The thickness of andesite exposed in this quarry, which is known as Sugar's Quarry, is about 120 ft. Though considered by Rands (1890) to underlie the Ipswich Series, it was later mapped by Cameron (1923) and Jones (1927) as Tertiary Basalt.

At the old Mount Crosby Weir the andesite is no more than five feet thick. It overlies some thirty feet of andesitic tuff.

The Mount Crosby Insect Shales.—The shales occurring at the base of the Kholo Conglomerate are characteristically greenish (fawn when weathered) and very fine-grained. Insect remains are relatively abundant in certain bands in these shales. They have been found in the following localities: (1) Riverbank in portion 68, Kholo; (2) Roadside, between portions 172 and 92, Chuwar; (3) Railway cutting in portion 202, Chuwar; (4) Portion 171, Chuwar; (5) Portion 11, Kholo; (6) Portion 26A, Kholo. Two specimens from locality (2) have been described by the late R. J. Tillyard (1937). Dr. Tillyard subsequently visited the locality and made a very large collection of fossil insects, which he was in process of examining at the time of his death in 1937. Though his examination was only in its preliminary stages Dr. Tillyard had already indicated that the collection contained an amazing wealth and variety

of insect remains, rivalling the famous Denmark Hill beds lying near the top of the Ipswich Series. A third specimen from locality (2) has been described by N. B. Tindale (1945). Tindale lists the localities where insect remains have been found and mentions that all except one were discovered by Mr. H. G. S. Cribb of the Geological Survey of Queensland.

The shale occurs in two sections, each 20 to 30 ft. thick and separated by about the same thickness of sandstone and/or conglomerate. Both sections contain insect and plant remains.

At locality (2) some of the intervening sandstone is highly calcareous. Here also there occurs a thin bed of rhyolitic tuff (Jones, 1927), suggesting that the insect beds are to be included in the "Acid Tuff" Stage of the Esk Series.

A seam of coal eight inches thick occurs near the base of the lower shale section at Mount Crosby old Weir (about half-a-mile below the existing weir). The coal, which is interlaminated with several bands of carbonaceous shale, has a peculiar scaly habit and is very bright. A sample of the clean coal gave the following proximate analysis:—

Moisture	1·9 per cent.
Volatile Matter	15·7 per cent.
Fixed Carbon	41·0 per cent.
Ash	41·4 per cent.

This seam also occurs at locality (4), where it appears to be somewhat thicker.

The Kholo Conglomerate.—The massive beds of the Kholo Conglomerate are magnificently displayed on the high banks of the Brisbane River between the Mount Crosby Weir and College's Crossing. The estimated thickness of this interesting accumulation of boulders is 800 ft. and the lithology is identical throughout the section. Occasional small lenses of sandstone are seen.

Miss D. Hill, who made a careful study of this Conglomerate, writes (Hill, 1931)—"More than 80 per cent. of the pebbles are made up of rhyolites and greywackes, and other types include trachytes, jaspers, quartzites, aplites, and various metamorphic rocks. The interbedded sandstones are of two types—brown and grey. The brown types often contain traces of equisetalian fossils, and are usually flaky. The grey are arkosic in nature, constituents being fresh biotite, quartz, and fresh felspars."

The Kholo Conglomerate (called by Cameron the "Basal Conglomerate") was found by Miss Hill to merge laterally, through the Bellevue Conglomerates, into the Esk Shales, her uppermost division of the Esk Series. The underlying shales and volcanic rocks are regarded as the local representatives of the "Acid Tuff Stage," the middle division of the Esk Series.

Kholo Conglomerate forming high bank of Brisbane River near Mount Crosby Pumping Station.

[*Photo.—A. M. McKenzie.*

As to the origin of the Kholo Conglomerate, Miss Hill came to the conclusion that it is an estuarine deposit representing a composite fan from more than one river, or a simple fan from one very large river. The present writer considers that the accumulation of such a thickness of coarse gravel in a river estuary would be highly improbable and that a more likely environment would be an upland or piedmont one.

Miss Hill (1931) stated that the conglomerate petered out altogether to the east of College's Crossing, a new but transient conglomerate appearing at Pullen Vale. My mapping indicates that the conglomerate is continuous from College's Crossing to Pullen Vale, though its outcrop is masked in places by later formations. Owing to the uneven floor on which the sediments were deposited the thickness of the conglomerate is liable to considerable fluctuation, but it appears to become progressively thinner approaching Pullen Vale.

The conglomerate has been quarried in places and the debris from it has been extensively removed for road metal and other purposes.

The Tuff Beds.—Overlying the "basal conglomerate" there is a succession of flaggy shales and acid tuffs with two or more horizons of coal and coaly shale. The predominant colour of these sediments is pale green to light grey. The tuff beds are interstratified with banded shales and were undoubtedly deposited under water. The shales are characteristically flaggy. In places they are cherty, and they frequently show colour banding. It is considered that the cherty beds were originally deposited as impure gelatinous silica, derived from the subaqueously deposited tuffs. Some fine examples of contemporaneous folding of the banded cherty shales are to be seen in the railway cuttings in portion 189, Chuwar. The shales are devoid of fossils.

Alternating coal and shale bands occur on two or more horizons, but nothing approaching a workable section of coal has been seen. In a railway cutting in portions 203 and 186, Chuwar, twenty feet of coal and shale bands can be seen lying near the base of the tuff beds.

The Tuff Beds have their maximum development about portion 193, Chuwar. They thin out gradually to the east and have not been seen beyond portion 59, Chuwar. Steeply dipping tuffaceous beds are seen in the vicinity of the old Waterworks in portion 366, Brassall, but the associated flaggy shales are not in evidence hereabouts. The maximum thickness of the Tuff Beds is estimated at 120 ft.

The "White Conglomerate".—The tuff beds are succeeded by a bed described by Reid and Morton (1922) as the "white conglomerate", and mapped by

Bar of "White Conglomerate" in Bed of Sandy Creek. [*Photo.—A. M. McKenzie.*

Kholo Bridge spanning the Brisbane River north of Ipswich. Outcrop of "White Conglomerate" under bridge at far bank.

[*Photo.—A. M. McKenzie.*

them from portion 161, Brassall, to portion 191, Chuwar. The writer has traced this bed as far east as portion 31A, Chuwar. The lithology of the bed is rather variable. In the vicinity of the old Waterworks it is a yellowish pebbly conglomerate, but going east it changes to a hard white silicified sandstone or fine conglomerate with rather angular pebbles. Further east it changes to a resistant, massive, yellow sandstone with odd pebbly bands. The bed has a maximum thickness of about 60 ft.

The Tivoli Stage.

It is proposed to include in the Tivoli Stage all the beds between the "White Conglomerate" and the sandstone overlying the Garden Seam. The selection of the upper limit of the Stage is somewhat arbitrary, for, notwithstanding an apparent change in the type of coal above the Garden Seam, there is no marked lithological change in the strata. The stage embraces all the worked seams of the North Ipswich mining district as well as a number of seams that are not known to have any workable section.

The Chuwar Shales.—The name "Chuwar Shales" is proposed for a succession of shales, carbonaceous shales, and coal seams between the White Conglomerate and the Benley Seam.

The "White Conglomerate" gives place abruptly to a thin shale bed, which, in turn, is succeeded by a thick section of coal and shale bands, called by W. E. Cameron (1923) the "Big" Seam. After mapping the area about the old Waterworks and Kholo Bridge, Reid and Morton (1922) came to the conclusion that the seam at the old Ipswich Waterworks, which they named the Waterworks Seam, was identical with Cameron's "Big" Seam; as my fieldwork fully supports this view it is proposed to call the seam the Waterworks Seam. The maximum thickness of this seam, as measured in Sandy Creek, where its full section is exposed, is about 70 ft. There is some doubt as to the exact position of the top of the seam, as thin coal bands continue well up into the overlying shale. The seam has been traced as far east as portion 58, Chuwar, but the overlying shales are gradually replaced in this direction by sandstone. Though the outcrop in portion 58 is some three chains wide, no sign of the seam has been found any further east, and it is concluded that it has been washed out or replaced, together with the overlying shale beds, by an invasion of sandstone. On the road running from portion 56 to portion 12, only sandstone or sandy soil is to be seen. There can be very little shale or coal in this belt of country, for outcropping sandstones are

practically continuous over wide areas. A small coal crop with perhaps ten feet of overlying shale is to be seen on the road between portions 56 and 21A; but going east it pinches rapidly and soon dies out altogether. The top of the "basal conglomerate" cannot be defined precisely in this area, as it merges into the overlying sandstones by a progressive decrease in the size of the pebbles.

Between the Waterworks Seam and the Benley Seam there are some 500 ft. of shale in which coal bands are of frequent occurrence. The latter appear to be extremely variable in frequency. In places, as in portion 99, Chuwar (near the Kholo Road), and portion 178, Chuwar, the coal bands are concentrated enough to warrant the title "seam". A tunnel was driven on one of these seams in portion 176 near the old Mount Crosby Road for a distance of 175 yds. or more. It was found to consist largely of bands of "bluey" with only thin streaks of coal. The shales thin out east of the surveyed town of Chuwar and eventually disappear altogether. A lens of sandstone makes its appearance towards the western end of the field. This sandstone outcrops prominently on the south bank of Mustering Gully in portion 46, Chuwar, where the stone has been quarried for building purposes. The general presence of pebbles limits the usefulness of this stone, though its hardness, resistance to weathering, and freedom from minor joints are features in its favour.

The shales overlying the Waterworks Seam also include some calcareous rocks. In portion 161, Chuwar, there occur alternating beds of argillaceous limestone and shale which sometimes contain thin layers of nearly pure limestone with fibrous habit, the fibres being normal to the bedding. Small lenses of limestone showing fibrous structure were seen on a somewhat higher horizon in the shales exposed on the south bank of Mustering Gully at the eastern end of portion 46, Chuwar.

Abermain Productive Beds.—The strata enclosing the productive coal seams of the North Ipswich district consist of thick shale and interbedded thick sandstones which are all lenticular to a greater or less degree. The sandstone is always coarse and massive, and usually pebbly.

Owing to the lenticularity of the sandstones, and probably also of the shales, the distance apart of the coal seams varies a great deal, but in general they are further apart than the seams in the Bundamba district. The seams, as well as the enclosing sediments, vary greatly in thickness, some of the smaller seams being of very limited extent. Very thin beds of limestone and calcareous shale occur in this stage. The outcropping shales differ from those of the Blackstone Stage in being generally of a fawny shade and often micaceous, whereas the latter are deficient in mica and usually reddish to blue-grey in colour. The average thickness of the beds from the Benley Seam to the Garden Seam is approximately 1,050 ft.

The Cooneana Stage.

Above the Garden Seam, coarse, pebbly sandstones and thin interbedded shales continue for at least 500 ft. before they plunge under Tertiary basalts, &c. Several seams of coal occur in this section, but, with one possible exception, they are not known to be workable.

The continuity of the Ipswich Series between North Ipswich and Bundamba is interrupted by a belt of overlying Tertiary rocks. The lowest beds outcropping in the Bundamba district are a thick succession of shale and ironstone beds which are exposed mainly in the Cooneana Estate. Lenticular beds of coarse sandstone similar to those of North Ipswich occur in these shales. They were named by W. E. Cameron (1907) the "Cooneana Sandstone" and mapped by him as a single continuous horizon. The recent survey, however, showed that the "Cooneana Sandstone" is not one continuous unit, but consists of a number of lenses of sandstone on more than one horizon.

On the question of the relation of the Cooneana Sandstone to the strata at North Ipswich Cameron (1907) wrote—"The Cooneana Sandstone . . . . is apparently identical with a sandstone which stretches across the western portion of Ipswich from the quarries at the end of Harlin Road past the back of the Grammar School, and is found again overlying the North Ipswich Seams about Tivoli."

In its lithology and massive character the "Cooneana Sandstone" bears a close resemblance to the sandstone beds overlying the Garden Seam. Similar sandstones with interbedded shales persist for approximately 500 ft. above that seam before plunging beneath the Tertiary strata. South of the Bremer River massive pebbly sandstone (Cooneana type) is found as far south as Recreation Reserve R.822 where it is estimated to be some 300 ft. above the highest beds exposed in North Ipswich. This sandstone is approximately 600 ft. below the Aberdare Seam, as is also the "Cooneana Sandstone" at Bundamba. We thus have some 800 ft. of strata between the Garden Seam and the top of the "Cooneana Sandstone".

It is proposed to include in the Cooneana Stage all the strata lying between the Garden and Rob Roy Seams, consisting chiefly of coarse sandstone at the base and of shales with highly lenticular sandstones in the upper part. It is considered that three of the Braeside Seams lie within this stage while a number of other seams have been recorded at lower horizons. Limestone has been found associated with the shales of the Cooneana Stage in the form of nodules and thin beds and, rarely, as lenses of impure crystalline material.

The Blackstone Stage.

This Stage embraces all the strata from the pavement of the Rob Roy Seam to the base of the Aberdare Conglomerate, and it includes all the important seams of the Bundamba and Dinmore districts. The beds are essentially shales and sandy shales with a number of lenticular sandstone beds.

The Rhondda Shales.—The term "Rhondda Shales" is proposed for the strata lying between the pavement shales of the Rob Roy Seam and the Four Foot Sandstone. Cameron (1907) had named these beds the "Bundamba Shales," but, because the name "Bundamba" had already been given to a younger series in the district, the term has not been generally adopted. (See Bryan and Jones, 1944.)

The "Rhondda Shales" include four workable coal seams, the Rob Roy, Striped Bacon, Bergin's, and Four Foot. The strata are mainly shales (which are often inclined to be sandy) and thin beds of sandstone, but thick lenses of sandstone occur on a number of horizons. The sandstone is of rather more frequent occurrence in the southern and eastern parts of the field. Important lenses occur between the "Top Coal" and the main Four Foot Seam at *Rylance No.* 3 *Colliery;* between the Four Foot and Bergin's Seams at *Rhondda Colliery;* and below the Bergin's Seam in portion 129, Bundamba. The last-named has a maximum thickness of 120 ft.

The Four Foot Sandstone.—W. E. Cameron (1907) described a bed of sandstone lying immediately above the Four Foot Seam which, he said, was a persistent bed forming a readily traceable horizon and which, he claimed, had been mapped with a considerable degree of accuracy over the greater portion of the district. In the map accompanying the report the Four Foot Sandstone included sandstones now known to belong to a number of different horizons. The 1923 map, though not showing the Four Foot Sandstone, amended the positions of some of the seams and indicated quite clearly that much of the sandstone previously mapped as "Four Foot" was considered to belong to higher horizons.

The Four Foot Sandstone, like most other sandstones in the Ipswich Series, is somewhat lenticular. It is suspected also that it may occur on more than one horizon, for, whereas at Blackstone, sandstone immediately overlies the Four Foot Seam, elsewhere the sandstone is separated from the seam by upwards of 100 ft. of shale.

In the vicinity of Bundamba the Four Foot Sandstone does not outcrop, being largely concealed by alluvium and Tertiary strata, but even where not concealed it cannot be traced, suggesting that it is probably very thin or very soft. It is first seen at Blackstone where it outcrops strongly above the Four Foot Seam in *Ladysmith* (*United No.* 2) *Colliery*, its thickness here being 30 ft. The records of the Cardiff Bore, 30 chains to the west, show only 22 ft. of sandstone above the Four Foot Seam. To the south-east soft sandstone is seen in an old air shaft to the Four Foot Seam in portion 295, Goodna. Massive sandstone appears in portion 286 but here it is some distance above the Four Foot Seam. In *Rhondda No.* 2 Shaft the Four Foot Sandstone is reported to be 65 ft. thick and separated from the Four Foot Seam by 100 ft. of shale.

Towards Dinmore the Four Foot Sandstone appears to die out altogether, as it has not been seen outcropping nor reported in underground workings in either *Whitwood* or *Rylance No.* 3 *Colliery.*

Cameron states that the Four Foot Sandstone is 300 ft. thick at Blackstone but does not indicate where the section was measured. Nothing approaching such a thickness of sandstone was seen by the writer, or is indicated in shaft or bore records.

The Aberdare Shales.—In the Blackstone district there is a succession of shales about 400 ft. thick between the Four Foot Sandstone and the Aberdare Conglomerate. These shales contain two thick seams of coal, the Aberdare and the Bluff. They have been subjected to extensive erosion in three different periods, viz., pre-Bundamba, pre-Tertiary, and Recent. As a consequence very large quantities of valuable coal have been lost. Sandstone lenses occur within the Aberdare Seam in the area south of Blackstone.

Palaeontology.

During the course of the survey all exposures of shales seen were searched for fossils. At this time Messrs. O. A. Jones and N. J. de Jersey, of the University of Queensland, were engaged in a taxonomic study of the Ipswich flora, and these gentlemen also made a large number of collections. An important palaeobotanical paper by Messrs. Jones and de Jersey embracing the flora of the Ipswich field is now in course of preparation.* Previously few fossils had been recorded from the Ipswich field outside of the prolific and well-known collecting ground at Denmark Hill. Identifiable fossils were found by the writer at more than fifty localities, most of which are new. Several of the new localities are quite prolific, though, for variety of forms, none can approach Denmark Hill. The collections also include a number of forms new to the field and several undescribed species.

Amongst the new records is the genus *Rienitsia*, two species of which (both new) have been recognised by Messrs. Jones and de Jersey. Specimens of this fossil have been found at numerous localities at horizons ranging from the base of the Waterworks Seam to the shales overlying the Aberdare Seam. In places it is very abundant and may even be the dominant form, as in the roof shales of the Bluff Seam at Box Flat Extended No. 5 Colliery. The extraordinary thing is that this form has not been recorded from Denmark Hill though its range is known to extend above the horizon of the Denmark Hill shales. The genus *Rienitsia* has not previously been recorded in Queensland.

Another new record for the field (and the State) is the genus *Johnstonia*. This has been collected from several localities at North Ipswich all in the Tivoli Stage. In an outcrop of grey shale in Sandy

* This paper was published on 15th June, 1947, as University of Queensland (Department of Geology) Paper, Vol. III (N.S.), No. 3.

Creek in portion 183, Chuwar, it is the most abundant fossil. Three species of *Johnstonia* have been recognised by Messrs. Jones and de Jersey.

In addition to plant remains, there are two rich insect-bearing horizons, and single insect wings have been found at two other horizons. The bivalve crustacean *Estheria* has been found at two localities. The freshwater pelecypod *Unio* has been recorded from a number of localities generally as single specimens, but in the floor of a shale quarry in portion 226, Goodna, numerous specimens were found generally in clusters of half-a-dozen or so and all within a single band of shale. These bivalves are usually preserved as limonitic casts though a few have been found as impressions in shale.

Fossil wood is abundant but much of it occurs as ironstone replacements. Flattened tree trunks were seen as silicious replacements forming beds overlying a number of coal seams. In portion 155, Bundamba, the writer saw a partially disintegrated tree trunk of coniferous wood with a minimum diameter of six feet and about 30 ft. long. Another large specimen was dug up at *Rhondda Colliery* in an excavation for a mine building, and fragments of it are now strewn about the surface.

Apart from Denmark Hill, the best collecting ground known to the writer is a spoil dump in a quarry in or about the north-western corner of portion 270, Goodna, near Blackstone township. The material came from a tunnel driven through the shales overlying the Aberdare Seam. Fourteen species are known to occur here and, in addition, *Estheria, Unio,* and an insect wing (found by Mr. de Jersey) have been collected. Unfortunately the shale containing the fossils is fast weathering away but a large amount of lump material has been collected for future examination. The shale is grey to black and fine-grained. In many cases the cuticle of the plants is preserved.

Amongst other good collecting grounds are the left bank of Mihi Creek, three chains up from the Bremer River, where the fossils are preserved in a dark grey to black shale which yields a little oil on destructive distillation; portion 179, Chuwar, in shales underlying the Waterworks Seam; portion 78, Chuwar, in a deep washout near *Abermain* Shaft; portion 108, Chuwar, a dark grey to black shale in the right bank of Sandy Creek; portion 78, Chuwar, a cherty shale band in the bed of Sandy Creek in which the leaf impressions are indelibly sculptured in the rock (notable for abundance of *Sphenopteris superba,* Shirley).

Detailed studies of the fossil plants have been made by Tenison Woods (1883), Shirley (1898), and Walkom (1915, 1917A, 1917B); and of the insect remains from Denmark Hill by Tillyard and Dunstan (1924). Two insect wings from Mount Crosby have been described by Tillyard (1937), and one from the same locality by Tindale (1945). Two species of *Unio* have been described by R. Etheridge, Jr. (1892), but no general study has been made of these fossils. No petrified wood from the Ipswich field has been described.

The age of the Ipswich Series based on palaeobotanical evidence has been variously regarded as Jurassic (by Tenison Woods, 1883); "Upper Trias-Jura" (by Jack and Etheridge, 1892); Rhaetic or Upper Triassic (by Walkom, 1918); Keuper or Middle Triassic (by Hill, 1930).

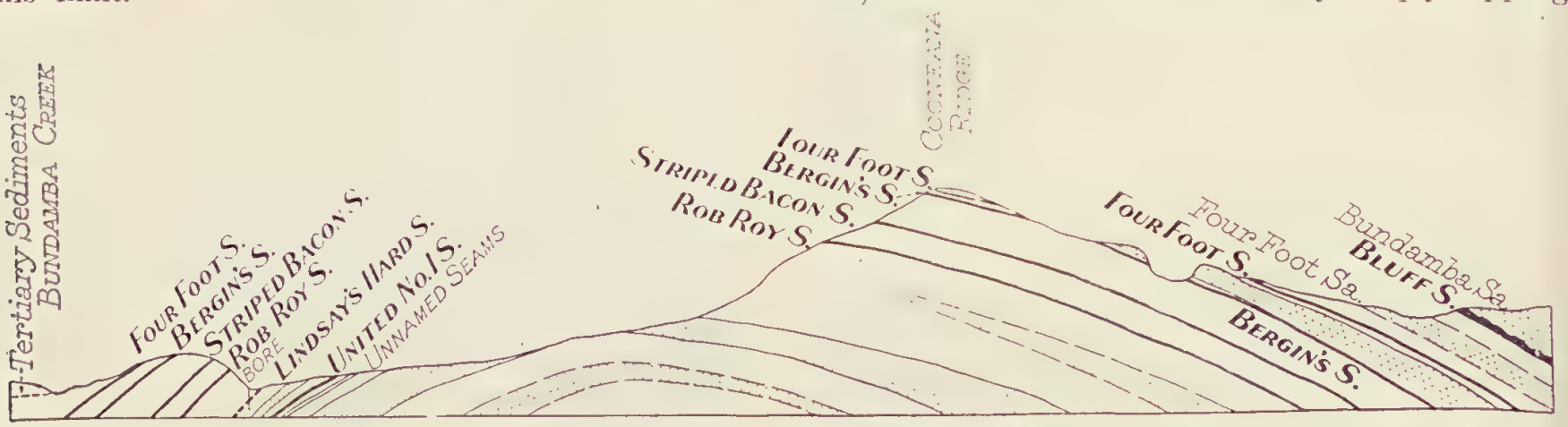
Petrified tree trunk still partly embedded in shale. Portion 225, Parish of Goodna (Scarborough's Hill). [*Photo.—A. M. McKenzie.*

CHAPTER 3.

FOLDING—FAULTING—IGNEOUS ACTIVITY.

Folding.

The strata of the Ipswich Coalfield have a general southerly to south-south-easterly dip of the order of 10 degrees to 15 degrees; they have also been subjected to compression, resulting in a series of folds with axes parallel to the general dip. The most important structure is an anticline with its axis passing a little to the east of Bundamba railway station. North of Bundamba the Ipswich beds plunge beneath Tertiary rocks, but where they reappear on the north side of the Bremer River there is only a suggestion of a pitching anticlinal structure. To the south the structure has been mapped for five miles and it must persist for some distance beyond this limit.



SKETCH SECTION ACROSS BUNDAMBA ANTICLINE
(CORONATION OLD COLLIERY TO RHONDDA COLLIERY)

HORIZONTAL SCALE (CHAINS) 8 4 0 8 16
VERTICAL " (FEET) 100 50 0 100 200

The structure is slightly asymmetric, dips on the west side being a little steeper on the whole than those on the east. The axis of the fold is somewhat sinuous but its average trend is 15 degrees west of north. The fold pitches to the north-west in the Bundamba area and to the south in the southern part of the field. It is also crossed by a synclinal fold with its axis striking east and west in the vicinity of the old Mafeking Colliery. There are thus two dome structures along the line of the Bundamba Anticline.

On the west flank of the anticline there are several subsidiary folds. An anticlinal fold is present in the workings of *Box Flat Extended No.* 4 *Colliery,* and mine plans show that the structure continues into *Aberdare Extended Colliery* to the north-west and into the old Swanbank workings to the south-east. This structure which I have called the Swanbank Anticline is plainly seen at the surface on the road between portions 219 and 220, Ipswich.

A study of the mine plans reveals further folding in the old *Box Flat Colliery.* The Aberdare Seam is bent into a rather sharp syncline flanked on the west by an open anticlinal fold (in *Aberdare* and *Aberdare Extended No.* 2 *Collieries*) and on the east by an open anticline and a second syncline. The folding is hardly noticeable at the outcrop of the Aberdare Seam, though some indication of it is apparent in the overlying strata on the road adjacent to portions 299 and 300, Goodna.

A second anticline of smaller dimensions but of greater intensity than the Bundamba structure occurs to the east of Six Mile Creek. Steeply dipping strata along this line of disturbance have been seen at intervals from portion 121, Goodna, to portion 283, Goodna. In the former locality steeply dipping shales are seen underlying Tertiary shales, &c. Mesozoic rocks are again visible on the Redbank Plains Road between portions 75 and 79, Goodna. Here again they are steeply inclined, but with rapidly changing strike, forming a closed structure.

Immediately north of this, in portions 69, 70, and 71, there is a second dome with rather flatter dips, while a third dome is seen in portions 284 and 285. These closed structures are not apparent on the latest Cameron map (1923); but a MS. map prepared by Mr. J. H. Reid of the Geological Survey of Queensland, shows the most northerly of them. The anticline fades out in portion 285, but an open anticlinal structure with a south-westerly pitch mapped between Dinmore and Redbank may be connected with it.

Mr. Cameron (1907) drew attention to the fact that the beds at Blackstone, after dipping under the basalt sheet about Booval, reappear at Ipswich City, thus forming a syncline which he named the Booval Syncline. Mr. Cameron pointed out that the strike of the Aberdare Seam in the northern levels of *Coolgardie Colliery* swings towards the west Recently the Four Foot Seam has been shown to swing towards the west in *Aberdare No.* 6 *Colliery*

at Bundamba in sympathy with the higher seam. It was at first thought that the Aberdare Seam would be found under a thin basalt cover along the railway about Booval and East Ipswich. It was subsequently found, however, that the basalt and associated Tertiary sediments attained a thickness of 900 ft. or more in the synclinal area, and that the underlying Ipswich beds were correspondingly eroded, the base of the Tertiary beds being more than 800 ft. below sea-level. As erosion could not take place much below sea level, it follows that the Tertiary beds must have been lowered at least 800 ft. with respect to sea level since their deposition. The existence of basal Tertiary beds 300 ft. above sea level at Dinmore gives some indication of the magnitude of the vertical movements which must have taken place in late Tertiary or Recent times. Further evidence of vertical movements of the Tertiary beds is afforded by the steeply dipping basalt, limestone, and shale on Limestone Hill, East Ipswich.

The productive beds of the Ipswich Coalfield come to an abrupt end along a line running north-north-west–south-south-east and passing through Thomas Street Railway Station west of Ipswich, the coals worked west of this line belonging to the later Walloon Series. Westward of this line the strata are first vertical and then dip to the west at decreasing angles only to steepen again, until they are obliterated by overlying sub-horizontal strata of Walloon and/or younger age. Further south the Walloon strata themselves are reported to be included in the zone of steeply dipping strata. This disturbance is the West Ipswich "fault," a zone of steeply dipping rocks of varying ages traceable for many miles both north and south of Ipswich. Approaching the "fault" from the east the Ipswich beds are seen to be sharply folded for distances varying from a few chains to half-a-mile.

The relationship of the Walloon Series to the Ipswich and Bundamba Series has already been fully discussed; and it has been pointed out that Cameron's interpretation of the West Ipswich disturbance as a normal fault passing into a monoclinal fold (as indicated by his sections) is untenable.

The idea of a middle Mesozoic oregeny is not a new one. Reid and Morton (1922) postulated an unconformity between their "Borallon" Series and the overlying Ipswich beds. This view they later retracted (Reid and Morton, 1924) but they were

Fault in Railway Cutting, R. 374, Parish of Goodna.

[*Photo.—A. M. McKenzie.*

obviously still at a loss to account for the juxtaposition of horizontal Walloon beds and vertical Bundamba, Ipswich, and Esk beds.

Beyond the boundaries of the Ipswich Field we find evidence of mid-Mesozoic folding in the vicinity of Nambour on the North Coast Railway 65 miles from Brisbane. For many miles south of Nambour the railway passes over sub-horizontal to gently dipping sandstones and sandy shales not unlike the Helidon (Marburg) Sandstone. Immediately north of Nambour the sandstones give place to a succession of strongly folded volcanic lavas, tuffs and shales (reported to contain thin coal seams) which persist at least as far north as Eumundi (76 miles from Brisbane). At North Arm Morton (1931) found shales associated with the volcanics containing an assemblage of fossils which Whitehouse (1931) stated were probably of lower Jurassic age, the horizon being very little above the top of the Ipswich Series. It is evident that the sandstones are unconformably related to the folded, predominantly volcanic series north of Nambour.

The severe folding (including over-folding and thrust faulting) of the Ipswich beds approaching the vertically disposed Bundamba Sandstone must have been developed by compressive forces acting normal to the trend of the disturbance. Surprisingly no evidence of thrusting or close folding was seen in the vertical or steeply dipping Bundamba Sandstones, and it is suggested that the steep dips could only have been brought about by normal faulting or monoclinal folding. It seems that the Bundamba beds were first upended as a result of a large-scale downwarping over a wide zone and that the adjacent Ipswich beds were subsequently squeezed against the relatively stable mass of steeply dipping sandstones and as a result were locally folded and faulted.

Faulting.

The Ipswich Coalfield is traversed by a large number of faults. They have exercised a great influence on the distribution of the various seams, causing the preservation of some and the destruction of others. Their effect on mining has been mostly, but not entirely, detrimental. Where a number of relatively large faults occur close together as at *Rylance No.* 3 and *Belmont Collieries* their effect on mining may be serious. Faults have been found striking in almost all directions, but, as Cameron (1899) pointed out, the dominant trend is north-west and south-east. This is the strike of most of the major faults, but there are several roughly normal to this direction, while east-west faulting may be locally important, as in the Dinmore district.

The majority of the faults seen underground are normal faults, but thrust faults are not unknown. The latter are usually strike faults, as might be expected, the chief exception being the main fault in *Noblevale No.* 1 *Colliery,* which strikes west-north-west–east-south-east.

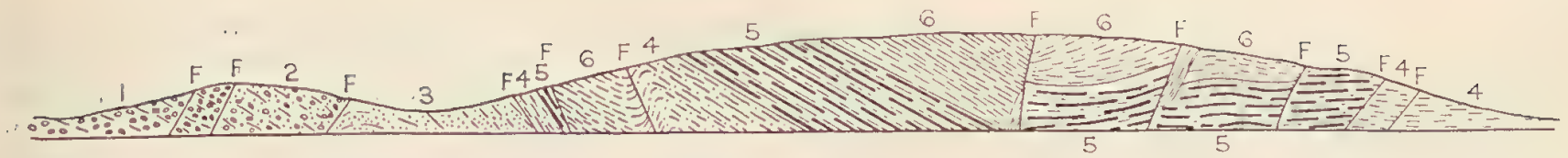
Some 200 faults (including major faults) are shown on mine plans of existing and abandoned collieries. A feature of many of the faults is their rapid lateral growth. This phenomenon is admirably displayed in the workings on No. 4 (Rob Roy) Seam in *Rylance No.* 3 *Colliery,* where movements on faults can be observed to grow from nothing to 30 ft. in 150 yd. or so. In *Blackheath Colliery* the throw of the Blackheath Fault increases from 60 ft. to 150 ft. in a distance of 350 yd. between Nos. 1 and 2 Tunnels. A parallel fault can also be seen to grow rapidly in the adjacent *Bonnie Dundee No.* 2 *Colliery.* An account of some of the more important faults follows.

The Bonnie Dundee Fault.—The workings of *Blackheath* and old *Bonnie Dundee Collieries* come to a sudden end against a fault which strikes approximately west-north-west–east-south-east. At the outcrop this is not a very big fault, the upthrow to the south-east being no more than 70 ft.; but there is a second parallel fault roughly seven or eight chains away with a displacement of the order of 350 ft. In the *Blackheath* workings, as they approached the main Bonnie Dundee Fault, they encountered a succession of step faults between which the coal was worked to a considerable height above the main workings. It is suggested that the two faults amalgamate in depth to form a wide fault zone.

The Bonnie Dundee Fault has not been traced in the field beyond the limits of the mine workings. There is a fault roughly in line with the Bonnie Dundee Fault in portion 12, Bundamba (*Southern Cross Collieries*) with a downthrow to the north-east of some 30 to 40 ft. This is possibly the Bonnie Dundee Fault near its north-western termination; or it may be an independent fault in the Bonnie Dundee line of crustal deformation.

The Mafeking-Extended Fault.—The mine plan shows the southern workings in *Mafeking Colliery* terminating along an east-west fault. The plan shows the fault swinging sharply northward across the bottom end of the main dip in portion 17. It is plain, however, that the main fault continues westward through portion 16 where it is believed to intersect the West Moreton Fault. The Mafeking Fault must grow rapidly going west, for, whereas in the upper levels of the *Mafeking Colliery* the downthrow to the north is approximately 90 ft., in portion 16 it is at least 350 ft. It continues on through *Aberdare Extended Colliery,* at least as far as Thornton Road in portion 2v, Ipswich. North of *Aberdare Extended* No. 1 Shaft the downthrow is about 260 ft., but the steeper dips on the north side of the fault indicate that the displacement is increasing towards the west.

The West Moreton Fault.—This fault has only been encountered in mine workings, which are not now accessible; it is nowhere visible at the surface. The fault was first met with in the *West Moreton Colliery.* After an inspection of the workings, Rands (1895) expressed the opinion that the coal had been thrown up to the south-west. This view was also held by Cameron (1907), probably following Rands. The section between *Aberdare Extended No.* 2 ("Round") Shaft and *Aberdare Extended No.* 1



SECTION – MT. CROSBY RAILWAY – SHOWING MULTIPLE FAULTING – PORTIONS 186, 203 CHUWAR

Length of Section approx. 5 Chains

1 Pebbly Conglomerate 3 Sandstone 5 Coal & Stone Bands
2 " Sandstone 4 Sandy Shale 6 Shale

Shaft, however, proves that the downthrow is to the south-west and of the order of 250 to 300 ft. There is no evidence that the fault was seen in *Coolgardie Colliery* north-west of the *West Moreton* workings. It cut off the coal to the dip in *Aberdare Extended No. 2 Colliery*. It does not persist beyond (south-east of) the Mafeking-Extended Fault, which intersects it in portion 220, Ipswich.

The Aberdare Fault.—The original *Aberdare Colliery* workings were cut off by a big fault striking north-east–south-west, the seam being thrown down to the south-west.† In the vicinity of *Aberdare No. 2 Tunnel* the throw is approximately 200 ft. The strata dip steeply to the south-east for some chains south-east of the fault. The main fault is flanked by a number of minor faults. To the south-west the Aberdare Fault appears to run out into a number of minor dislocations, all of which terminate against the West Moreton Fault.

The Coronation Fault.—W. E. Cameron on all his maps shows the Coronation Fault striking north-west and south-east, though he was careful to point out that he had not been able to obtain any definite information as to its strike. It is now known from the *Aberdare No. 6 Colliery* workings that the fault which cut off the coal in old *Coronation Colliery* strikes east-north-east–west-south-west and throws the Four Foot Seam down to the north by approximately 120 ft. at the outcrop of the Four Foot Seam. The fault has not been seen on the surface but the northerly dips seen near the southern boundary of portion 243, Goodna, may be due to its influence.

Gilliver's Fault.—This fault marks the southern and western limits of the Dinmore group of collieries. The worked seams were all thrown up to the south and west and are now almost completely eroded away. The Cameron map of 1923 shows the fault running in an almost straight line from portion 141, Goodna, to portion 255 and continuing from there in a south-easterly direction as the Whitwood Fault. Actually the Whitwood Fault, as seen in the Whitwood workings on the Striped Bacon Seam does not appreciably displace the seam. Gilliver's Fault was carefully traversed on the surface, and there seems little doubt that it branches somewhere about portion 257, the northerly branch going off as the New Chum Fault, while the southerly branch takes a gradual swing to the south, and, in portion 272, to the south-west. After being joined by a fault striking east-north-east–west-south-west, it apparently dies out in portion 252. Everywhere Gilliver's "Fault" consists of a wide zone of steeply dipping strata with some brecciation in places. Towards the southern end of portion 272 no actual break is discernible; the dips flatten somewhat and the disturbance becomes in reality a monoclinal fold. The New Chum Fault continues as far as *New Chum No. 4 Tunnel* in portion 268, but beyond that point it has not been traced for certain. It may be identical with one of the faults in the Belmont group of collieries.

Ebbw Vale Fault.—At Dinmore the worked seams abut against a big fault striking north-west–south-east. The several seams met with beyond the fault bear no similarity to any of the worked seams of the district and are believed to be some of the upper seams of the Cooneana Stage. At *Ebbw Vale Colliery* the throw is reckoned to be 450 ft. or more. The fault has been traced from portion 261 south-easterly to portion 215, Goodna, but beyond that it appears to die out rapidly. North-west of *Ebbw Vale Colliery* the fault plunges beneath a thin covering of Tertiary rocks. It is probably responsible for dips of 30 degrees in portion 139, north of the railway, but it must peter out before reaching the Bremer River because exposures on the north bank of that stream show no evidence of major faulting.

North Ipswich Faults.—Four of the faults shown on Mr. Cameron's 1923 map are deleted, as there is no evidence of their existence. The Boxwood-Bishop Fault System not only breaks the beds into a number of blocks but also throws them into a sharp synclinal fold and a number of minor folds one of which is responsible for the duplication of the outcrop of the Eclipse Seam. The Boxwood Fault has been traced from portion 194, Chuwar, to portion 134, Chuwar. Its continuation beyond the latter locality has not been demonstrated but it is considered very probable that it persists in this direction and may even link up with the Gilliver disturbance at Dinmore. The folding and other phenomena associated with the Boxwood Fault stamp it as a drag fault resulting from forces acting roughly parallel with the strike of the fault.

The Tivoli Fault can be traced in mine workings from the Bremer River north-westwards to portion 131, Chuwar. The seams are thrown down to the

† A section (presumably prepared by W. E. Cameron) through No. 2 Tunnel, shows the Aberdare Fault hading to the north-west. It follows that the Aberdare Fault is a thrust fault.

north-east by about 90 ft. for most of this distance, but toward portion 131 the throw appears to be rapidly decreasing. Approaching the Tivoli Fault from the north-east the Tivoli Seam improves greatly in quality while the lower Eclipse Seam deteriorates. Conversely the Eclipse Seam improves and the Tivoli Seam deteriorates approaching the fault from the south-west. There is a widely-accepted belief on the field that the fault has been responsible for these changes, but as the faulting took place long after the formation of the seams it could not have affected the coal, except, perhaps, for a yard or two on each side of it.

Igneous Activity.

Contemporaneous Activity.—So far as the writer has observed contemporaneous igneous rocks seem to be confined to the lowest or Kholo Stage of the Ipswich Series. There were three distinct periods of activity. The first andesitic phase was followed after a brief interval by a short-lived period of acid tuff extrusion. The third and final period of activity followed after a fairly lengthy interval and resulted in the deposition of the Tuff Beds which have already been described. The source of the tuff was evidently rather remote as plants were able to flourish in the vicinity, presumably during periods of comparative quiescence. In this connection it is probably of significance that the tuffs are to some extent water-sorted and do not carry any coarse clastic material.

B. Dunstan (1924) mentions a bed of tuff overlying the insect beds at Denmark Hill, but it could not be identified by the present writer.

Intrusive Rocks.—Igneous dykes have been seen or reported in a large number of colliery workings and a few have been located at the surface. Two circular intrusive masses of basalt have also been mapped—one in portion 7, Chuwar, and the other in portions 15, 16, 17, Bundamba. Where they pass through the coal the dykes are highly decomposed and consist usually of a white to yellowish kaolinic mass without structure. In one instance traces of vesicular structure were still discernible. On the surface the dykes are usually more or less decomposed, but unweathered outcropping dykes have been found in one or two places. Microscopic studies show the unweathered dykes to be mainly of basaltic composition. A dyke in portion 214, Goodna, is coarsely porphyritic, phenocrysts ranging up to one inch or more in length (See Appendix, p. 112). The metamorphic effect of the dykes on the invaded strata is usually insignificant, but the porphyritic dyke mentioned above has caused severe induration of the shale and silicification of the sandstones for a distance of five or six yards from the contact. The coal is usually coked for a distance of one to three feet from the contact, the width of coked coal being in general proportional to the thickness of the dyke. In some cases the dykes are associated with dislocation of the strata, but in the majority of cases there seems to be no discernible movement on the dyke fissures. Few sills of any importance have been observed. One occurs in *Box Flat Extended No.* 4 (formerly *Noblevale No.* 3) *Colliery* and a second was seen in a prospecting tunnel in Verrall Estate (New Aberdare East Collieries). An account of these sills will be found in Part II. In other places tongues were observed to run along the seams for a few feet.

Some of the dykes met with underground are of considerable persistence as, for example, the dyke traversing *Aberdare Extended* and *New Aberdare Collieries* which is reported to have been traced for nearly a mile. It is reported by Mr. J. Conway, Superintendent of Aberdare Collieries Pty. Ltd., to lie along a fault with a downthrow to the west of 14 ft.

CHAPTER 4.
THE SEAMS.

General.

The Ipswich Field contains twenty-four coal seams that have been worked, besides which there are numerous seams that are considered too small or too dirty to warrant further attention. Coal is found on many horizons between the Insect Beds of the Kholo Stage and the lower beds of the Bundamba Series but the worked seams are restricted to the upper 2,000 ft. of strata. The seams are of no great extent, the largest proved area occupied by any seam of workable quality and thickness being less than eight square miles (the Aberdare Seam). The seams are characteristically banded and the coal, with few exceptions, contains a high percentage of mineral matter. The seams normally grade both upward and downward through alternating stone and coal bands to dark-coloured shale, the "underclay," which is supposed to be diagnostic of coal seams deposited *in situ,* being absent in all the cases where the floor of the seam could be studied. All these conditions suggest that most, if not all, of the seams were not formed *in situ.* Sandstone roofs are not common, and where they do occur they are obviously associated with the erosion of the normal roof shales.

The coals are bright coals with one well-developed "cleat" or cleavage. In the North Ipswich area the main cleat direction runs west-north-west to east-south-east while in the Bundamba and Dinmore districts it runs north-east to south-west, but the direction is anything but constant even from one pit to the next. Only in rare instances could traces of a cleavage at right angles to the main "cleat" be discerned. "Backs" or planes of movement within the coal are of variable occurrence but I heard of no case where they were sufficiently numerous to demand any special measures to deal with them.

The quality of the coal in any particular seam is subject to considerable variation. The change is sometimes gradual, sometimes rapid. It is usually brought about by an increase in the mineral matter content of the coal, often rendering the seam unworkable; less frequently by increase in the number and/or thickness of the stone bands.

Stone bands are of three main types:—

1. Shale (including carbonaceous shale);
2. Fine-grained dense unbedded stone, coloured white or brown; and
3. "Boulder" or ironstone, consisting of carbonate of iron, argillaceous and carbonaceous matter and sometimes pyrite. These bands are always very irregular in thickness and often discontinuous.

The stone bands are generally lenticular, but in a few cases, such as the white bands in the Aberdare and Four Foot Seams and a thick band in the Bluff Seam, they may be very persistent. The bands vary from a parting a fraction of an inch thick up to more than two feet.

In addition to the straight-out stone bands, most of the Ipswich seams carry bands of "bluey." Material classed as "bluey" ranges from a low-grade splint coal to what may be described as black stone. It possesses a dull, sometimes sub-metallic, lustre and an uneven to sub-conchoidal fracture and usually shows little sign of bedding. The better quality "bluey" burns fairly well and is reported to have good heating value, though it leaves a high percentage of ash and usually clinkers. On exposure to the weather for any length of time "bluey" develops a whitish skin, revealing its stony nature. Bands of this material occur up to five or six inches in thickness. They are usually discarded in mining unless they are very thin.

Stone dykes or "runners" were seen in a few of the collieries. The "runners" are of three types—(1) Completely transgressive dykes with straight sides; (2) Flatly dipping, partially concordant dykes; and (3) Irregular, somewhat funnel-shaped stone bodies. These will be described in detail in connection with the collieries in which they occur. (See pp. 67, 68, 77, 82.) In some cases the stone dykes are of little importance, but they may become so frequent as to render a seam unworkable.

Little West Moreton Seam.

*Colliery:—West Moreton**.—This is one of several thin coal seams occurring in the lower portion of the Bundamba Series. It was intersected 468 ft. above the base of the Aberdare Seam in the *West Moreton Shaft,* which, allowing for a dip of 20 degress, would place it 440 ft. stratigraphically above the latter. At *Aberdare Extended Colliery* the two seams are 421 ft. vertically (approximately 390 ft. stratigraphically) apart. The seam has been traced from portion 219, Ipswich, where it has been prospected by an adit (now collapsed) driven in the bank of Bundamba Creek to portion 180, Goodna. The *West Moreton* workings on the seam extend under a thin cover of Tertiary beds into portion 179, but beyond that the seam has not been found, having been eroded prior to the deposition of the Tertiary sediments. The crop is nowhere visible on the surface, but it was possible to squeeze into an old tunnel on the seam in portion 180. The seam, which was in a slightly weathered condition, was found to be two feet thick at this point; but, according to Mr. A. Dobbie, who worked in the pit, the average thickness is one foot ten inches. The seam does not carry any permanent stone bands but one or two lenticular penny bands were observed.

Above the seam and separated therefrom by six inches of "bluey" there is a bed of oil-bearing shale or low-grade canneloid coal 18 in. thick. This is a black, laminated substance with a greasy streak and

* Abandoned.

The following table (Table 3) shows the worked seams of the Ipswich Field in descending order, with their mean and extreme thicknesses:—

TABLE 3—SEAMS OF THE IPSWICH COALFIELD.

Name of Seam.	Sections Worked.	Collieries (past and present) in which worked.		Thickness.	
		Greatest Vertical Depth.	Number.	Range.	Mean.
		feet.			ft. in
Little West Moreton	Whole	420	1		1 10
New Found Out	Whole	?	2	4′ 6″–6′	5 0
Aberdare	(Full Section)	1,900			13 0
Aberdare	Tops		13	2′–11′	6 0
Aberdare	Bottoms		23	2′–8′	6 0
Bluff	(Full Section)	440		5′–40′	28 0
Bluff	Tops		5	4′ 9″–6′ 3″	5 6
Bluff	Middle (in part)		2	4′ 1″–4′ 10″	4 6
Bluff	Middle (in part)		2		6 6
Bluff	Bottoms		4	3′–5′ 11″	5 0
Unnamed		500	4	3′ 4″–6′ 9″	5 6
Four Foot (or New Chum)	(Full Section)	600			22 0
Four Foot (or New Chum)	Top Coal		7	4′ 9″–6′ 7″	5 9
Four Foot (or New Chum)	Intermediate Section		1		4 4
Four Foot (or New Chum)	Brushing Band (worked with Main Seam)		3	11″–1′ 9″	1 2
Four Foot (or New Chum)	Main Seam		20	2′ 2″–5′ 3″	4 0
Bergin's (or Seventy Foot)	Whole	500	13	3′ 10″–14′	6 6
Striped Bacon (or Strip of Bacon)	Whole	450	9	3′ 8″–6′ 4″	5 3
Rob Roy	Whole	550	7	5′ 3″–7′ 1″	6 3
Braeside No. 1*	Whole	?	3		4 0
Braeside No. 2	Whole	?	2	3′ 0″–4′ 0″	
Braeside No. 3	Whole	250	2	2′ 9″–4′ 6″	
Braeside No. 4 (original Lindsay's Hard)	Whole	?	2		3 6
United No. 1†	(Full Section)				20 0
United No. 1†	Bottom Section	250	1	3′ 3″–3′ 9″	3 5
Riverside No. 1	Whole	120	2	5′ 5″–5′ 9″	5 6
Riverside No. 2	(Full Section)	220			18 4
Riverside No. 2	Top Coal		1	2′ 6″–2′ 10″	2 9
Riverside No. 2	Bottom Coal		1		4 3
Riverside No. 3	Full Section (not worked)				13 5
Garden	?	?180	2		3 6
Tantivy	Whole	?160	2		3 4
Fiery	(Full Section)				23 0
Fiery	Haighmoor Upper	230	2	3′ 3″–3′ 9″	3 6
Fiery	Haighmoor Lower	200	1	4′ 1″–4′ 6″	4 4
Waterstown	Whole	520	4	2′ 4″–3′ 7″	3 0
Unnamed	Whole	?	1		3 6
Tivoli	Whole	1,050	5	2′ 5″–5′ 5″	4 9
Poverty	Whole		0	Max. 2′ 6″	
Eclipse	Whole	620	8	3′ 10″–11′ 1″	5 9
Francis'	Whole	?	1		2 1
Benley	(Full Section)	120			10 2
Benley	Tops		3	3′ 10″–4′ 8″	4 2
Benley	Bottoms		1		3 2
Morris'	(Full Section)		0	15′–40′	20 0
Waterworks	(Full Section)		0	30′–70′	50 0

* Possibly identical with Rob Roy Seam.

† Possibly identical with Braeside No. 4 Seam.

lustre that has a wooden ring under the hammer. A sample yielded oil by destructive distillation at the rate of 14 gallons per ton of shale.

The seam has been worked in only one colliery, the *West Moreton* but it may be opened up soon in *Aberdare Extended Colliery.*

Aberdare Seam.

Collieries:—Borehole, Coolgardie*, Aberdare** (embracing *Hart's Aberdare,* etc.), *West Moreton*, Fairbank*, Box Flat*, Aberdare Extended No.* 1, *Aberdare Extended No.* 2*, *New Aberdare*, Bog side*, Mafeking*, Southern Cross No.* 1*, *Box Fla Extended No.* 4 (formerly *Noblevale No.* 3), *Souther Cross No.* 4*, *Swanbank*, Denham*, Box Fla Extended No.* 2 (*Parkhead*), *Box Flat Extended No.* 3*, *Southern Cross No.* 2 (*Green Gully*)*, *Bonn Dundee*, Blackheath, Fernie Creek* (later *Nobla vale No.* 4)*, *City* (later *Noblevale No.* 6)*.

The Aberdare is the uppermost seam of th Ipswich Series and in point of quality and workin

* Abandoned.

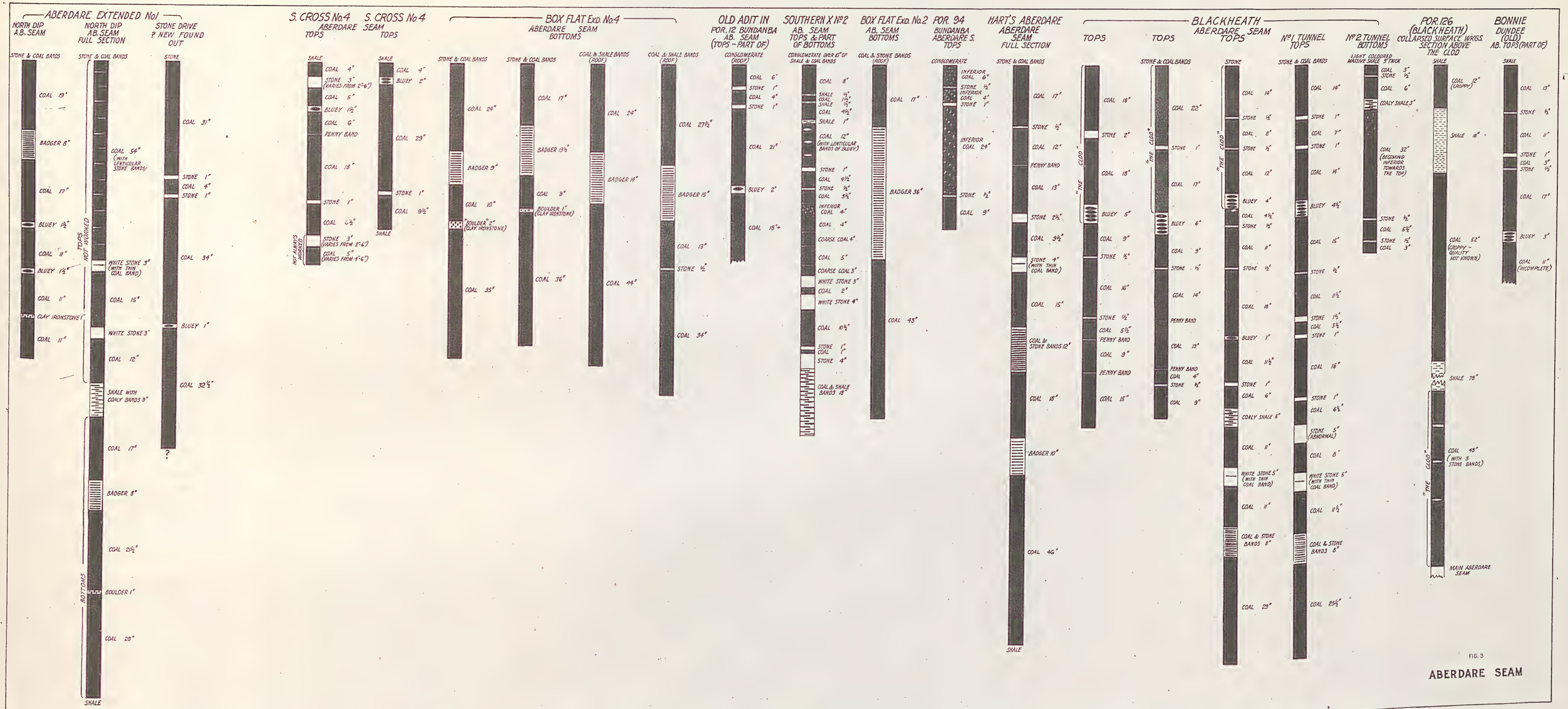


FIG. 3

ABERDARE SEAM

thickness it is by far the most important seam of the field. The coal is bright but rather soft and inclined to fall to slack unless carefully handled.

The seam proper is usually separated from the overlying Aberdare Conglomerate by a succession of shale and coal bands, the latter increasing in number as the seam is approached. The quality of the coal in the roof strata is reported to be very good. Over a limited area south of Blackstone these coal bands formed a workable section varying from 4 ft. 6 in. to 6 ft. thick which was exploited in *Box Flat* and *Aberdare Extended No. 2 Collieries* as the "New Found Out" Seam. Towards the southern end of the field the overlying shales were much eroded and in many places the Aberdare Conglomerate lies directly on the seam.

The main seam, except in *Blackheath, Fernie Creek, Bonnie Dundee,* and *Southern Cross No. 2 Collieries,* has been worked in two sections each about six feet thick, which are separated as a rule by a "badger" (a succession of thin coal and stone bands) about one foot thick. To begin with, only the bottom section, which contains better quality coal and fewer stone bands, was worked but subsequently the top coal was taken out as far as the state of the workings would permit. The stone bands in the Aberdare Seam are remarkably constant. The bottom coal carries a "badger" varying in thickness from eight inches to three feet but no other permanent stone bands. The top coal carries three constant stone bands, one of which, the "double white" band, consisting of two bands from one to two inches thick separated by about half-an-inch of coal, is particularly persistent and has been recognised in all accessible collieries on this seam.

The two "badgers" in the Aberdare Seam evidently represent periods of considerable subsidence, for they both give place laterally to beds of sandstone and shale 60 ft. or more thick. These lenses are not co-extensive though they overlap in the vicinity of *Box Flat Extended No. 2 Colliery*, where the top and bottom sections of the seam are 100 ft. or more apart.

The Aberdare Seam has been traced from portion 98, Bundamba, in a general north-north-westerly direction as far as portion 174, Goodna, where the outcrop is obscured by Tertiary sediments. Beyond that point the strike gradually changes and the seam runs westerly under a cover of Tertiary basalts and sediments, which attain a thickness of 900 ft. or more, to reappear at the surface in Queen's Park north of Griffith Road. West of Queen's Park the outcrop is obscured by a narrow belt of Tertiary rocks but it appears again on Denmark Hill. Immediately west of that eminence it becomes involved in the great West Ipswich faulting and finally disappears. The seam has not been recognised under the steeply dipping Aberdare Conglomerate running north-north-west from Thomas Street railway station.

In the southern part of the field beyond portion 98, Bundamba, the Aberdare Seam appears to have been completely eroded away by the denudation that preceeded the deposition of the Aberdare Conglomerate, which here directly overlies the Bluff Seam. The seam again crops out on the north side of the *Bonnie Dundee* and *Blackheath Collieries* as far as the old *Fernie Creek* tunnel.

The Aberdare Seam begins to deteriorate and becomes unworkable south of a line drawn from portion 209, Ipswich, to portion 144, Bundamba. At the latter locality the line of deterioration turns and runs first north-east, then north, then north-west, to cut the outcrop of the coal at *Fernie Creek Colliery*. As the workings do not continue west of portion 209, Ipswich, it is not known with any certainty what course the line of deterioration pursues. It may be significant, however, that the line if projected beyond portion 209 comes quite close to the line of eroded coal in the southern part of *City Colliery* at Denmark Hill. The coal is not known to make again anywhere beyond the line of deterioration described.

To the north and north-east of *Fernie Creek Colliery* thin crops of inferior coal or coaly shale have been located at several points where the Aberdare Seam might be expected to outcrop, notably where the Redbank Plains road crosses Fernie Creek. The seam (or seams) represented by these crops bears no resemblance either in the nature of the section or in the quality of the coal to the Aberdare Seam as worked in the various collieries. Being sandwiched between massive beds of silicious sandstone similar to the Aberdare "Conglomerate," it could be the equivalent of one of the small seams known to occur in that formation at Blackstone and elsewhere.

There is a widespread belief on the field that the seams worked in *Redbank Colliery* can be correlated with the Aberdare Seam, but the geological mapping renders such a correlation highly improbable.

Development of the Aberdare Seam has virtually ceased though considerable quantities of pillar coal remain to be extracted in *Box Flat Extended* and *Blackheath Collieries.* A wedge-shaped area between the West Moreton and Extended Faults which is now being opened up in *Aberdare Extended Colliery* may yield a comparatively large tonnage of coal, but conditions here are somewhat unstable and a serious creep may occur, necessitating abandonment of a part or all of the area. There remain two areas of probably exploitable coal—one east of *City Colliery*, Ipswich, and the other between the abandoned *Coolgardie* workings and the West Moreton Fault—the estimated total area of coal awaiting development being approximately 400 acres. The greater part of this coal lies between 800 ft. and 1,800 ft. below the surface. A considerably larger area of good coal is believed to lie below 1,800 ft. but a practicable method of working this deep coal has yet to be devised.

Bluff Seam.

Collieries:—*Bogside No.* 2 (*Noblevale No.* 5)*, *Southern Cross No.* 6, *Box Flat Extended No.* 5, *Thistle No.* 4, *Palmer's Aberdare**, *United No.* 5 *Extended* (formerly *Harris' Tunnel*), *Hare and Wall's Tunnel**, *Blackheath**, *?Happy Valley**, *Rylance No.* 3 (*New Chum*)*, *Whitwood No.* 3*.

The Bluff Seam was probably first discovered at Blackstone where it was intersected in the *West Moreton* and *Borehole* Shafts. A prospecting tunnel was also driven on it in the *Borehole Colliery* property, but in this district it did not show a workable section. About the same time it was being worked to a small extent at Dinmore (Thomas' Mine) as the Old Aberdare Seam, but the coal was inferior and could not be readily marketed.

The Bluff Seam lies about 100 ft. below the Aberdare Seam and is separated therefrom by shales and sandy shales with occasional thin lenses of sandstone. It varies in thickness from five feet (in *Blackheath Colliery*) to approximately thirty feet (in *Southern Cross No.* 6 *Colliery*). Three of the four collieries at present operating on the seam are working the section immediately next to the roof which averages about 5 ft. 6 in. in thickness. In these collieries the middle section of the seam, though rather badly banded, may include locally workable sections. The bottom section three to six feet thick is not excessively banded and is considered workable. Elsewhere portions of the middle section have been worked to a small extent.

The coal in this seam is hard and bright, but does not compare in quality with the Aberdare coal. About six feet from the roof of the seam there is a hard stone band about nine inches thick that shows only a trace of bedding. The greater part of this band is cream- or biscuit-coloured but the bottom inch or so usually has a reddish tinge. It is a very constant band and is regarded as being of diagnostic value. Thus the presence of such a stone band between five and six feet from the roof in the seam worked in *Palmer's Aberdare Colliery*, coupled with the absence of the usual Aberdare bands, is considered sufficient evidence for correlating the seam with the Bluff Seam, notwithstanding its juxtaposition to the Aberdare Conglomerate.

The Bluff Seam may be traced at intervals from Blackstone south-easterly to Hare and Wall's Tunnel and thence in a northerly direction across the Bonnie Dundee Fault to *Fernie Creek Colliery*. It is not known to have been prospected in the old *Noblevale No.* 1 property but it was intersected in *Rhondda No.* 2 Shaft where it was 15 ft. thick and eroded to some extent. From Rhondda the seam may be traced to the Whitwood and Rylance properties where it has been exploited to a small extent. The seam formerly worked in the small *Happy Valley Colliery* in portion 217, Goodna, was believed by the proprietors to be on the Bluff Seam. If it is the Bluff Seam it represents the most easterly known exposure of the seam.

None of the three seams observed to underlie the Aberdare Seam at Denmark Hill could be identified as the Bluff Seam. The uppermost of these is 115 ft. below the Aberdare Seam and is therefore in the right position for the Bluff Seam. However, it is only four feet thick and only the upper 18 inches are workable coal. The other seams are too far below the Aberdare Seam to be correlated with the Bluff Seam.

Though of somewhat wider distribution than the Aberdare, and of considerably greater average thickness, the Bluff Seam, chiefly because of its banded nature and the inferiority of much of the coal, has not been exploited to any very great extent. However, between *Bogside* and *Palmer's Aberdare Collieries* it has been proved in recent years to carry one or more workable sections. It is already being developed for large-scale exploitation in one colliery, and it is anticipated that the yield of coal from this seam will, in point of production, soon be rivalling that from the Aberdare Seam.

Unnamed Seam, Between Bluff and Four Foot.

Collieries:—*Bonnie Dundee No.* 2 *Tunnel**, *Bonnie Dundee Extended**, *United No.* 5, *Binnie's Tunnel.**

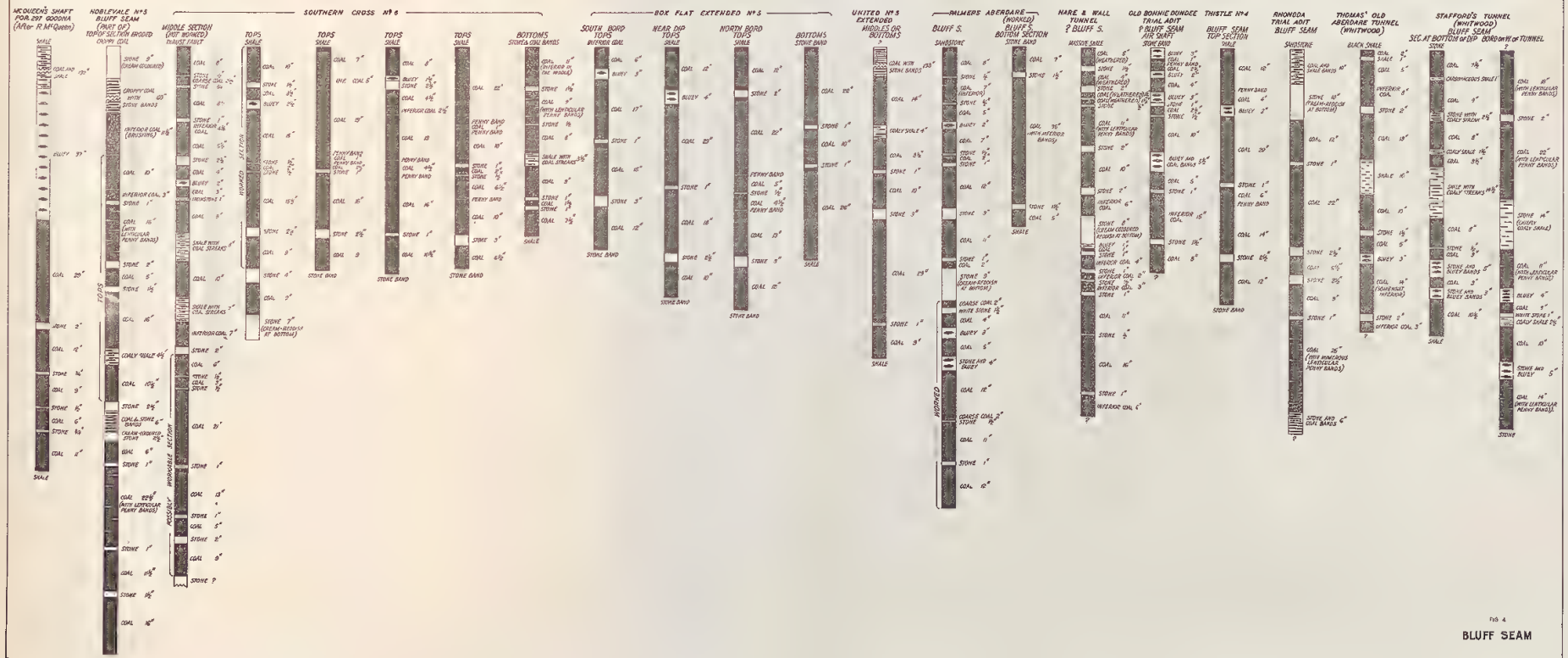
This seam has been seen only in the southern part of the field. It lies usually 100 ft. or more below the Bluff Seam and is separated therefrom by sandstone and shale beds.

On the western limb of the anticline it is first seen lying below the crop of the Bluff Seam in *Thistle No.* 4 Colliery (in portion 12, Bundamba). A seam of coal 170 ft. below the Bluff Seam in portion 5, Bundamba, may be identical with the seam in portion 12 as shallow boring showed it to be the first coal below the Bluff Seam. This seam was 15 ft. thick but did not have a workable section. What may be the same seam is being worked in *United No.* 5 (*"Ideal"*) *Colliery* in portion 94, Bundamba, where there is a 6 ft. section of quite fair quality coal. It has yet to be traced between there and *Binnie's Tunnel* in portion 152, Bundamba, but I have no doubt that a systematic search would show it to be present in this rather badly faulted area.

From *Binnie's Tunnel* the seam may be traced at intervals as far north as portion 286 just beyond *Blackheath* boundary. It was worked to a moderate extent in *Bonnie Dundee Extended Colliery* and in old *Bonnie Dundee* as No. 2 Seam.

The seam has a working section of 3 ft. 4 in. to 6 ft. 9 in. The coal in *United No.* 5 *Colliery* is of fair quality, but elsewhere the grade is rather inferior, especially as the limits of the seam are approached.

* Abandoned.


McQUEEN'S SHAFT POR. 297 GOODNA (After R. McQueen)
HOBLEVALE No 3 BLUFF SEAM (PART OF) TOP OF SECTION ERODED
SOUTHERN CROSS No 6
MIDDLE SECTION (NOT WORKED)
THRUST FAULT
TOPS
BOTTOMS
STONE & COAL BANDS
WORKABLE SECTION
WORKED
BOX FLAT EXTENDED No 3
SOUTH BORD TOPS
NEAR DIP TOPS
NORTH BORD TOPS
BOTTOMS
UNITED No 3 EXTENDED
MIDDLES OR BOTTOMS
PALMERS ABERDARE (WORKED)
BLUFF S.
SANDSTONE
BLUFF S. BOTTOM SECTION
HARE & WALL TUNNEL ? BLUFF S.
MASSIVE SHALE
OLD BONNIE DUNDEE TRIAL ADIT ? BLUFF SEAM AIR SHAFT
THISTLE No 4
BLUFF SEAM TOP SECTION
RHONDDA TRIAL ADIT BLUFF SEAM
THOMAS' OLD ABERDARE TUNNEL (WHITWOOD)
BLACK SHALE
STAFFORD'S TUNNEL (WHITWOOD) BLUFF SEAM
SEC. AT BOTTOM OF DIP BORD ON W. OF TUNNEL
SCALE
STONE BAND
FIG 4.
BLUFF SEAM

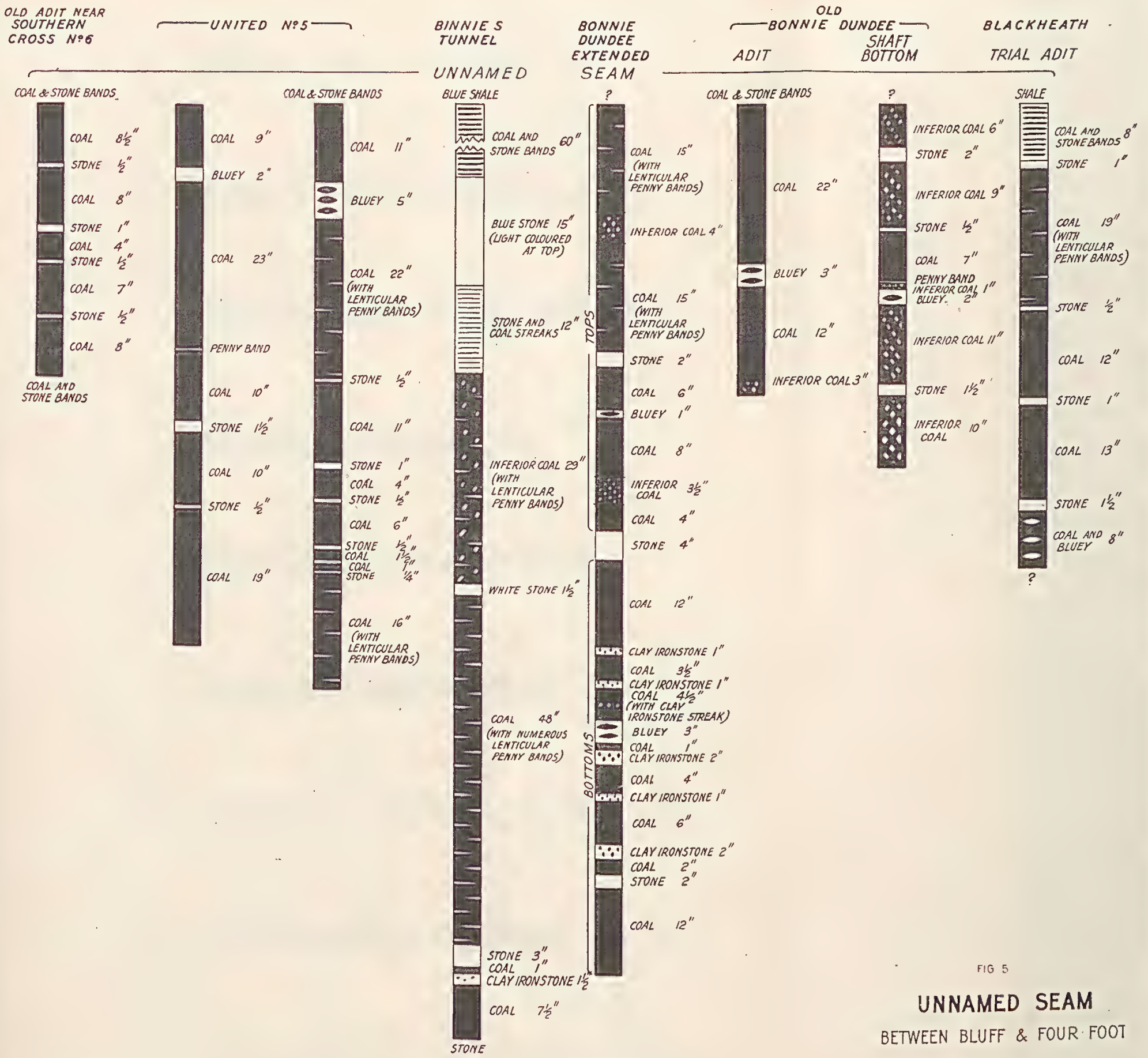
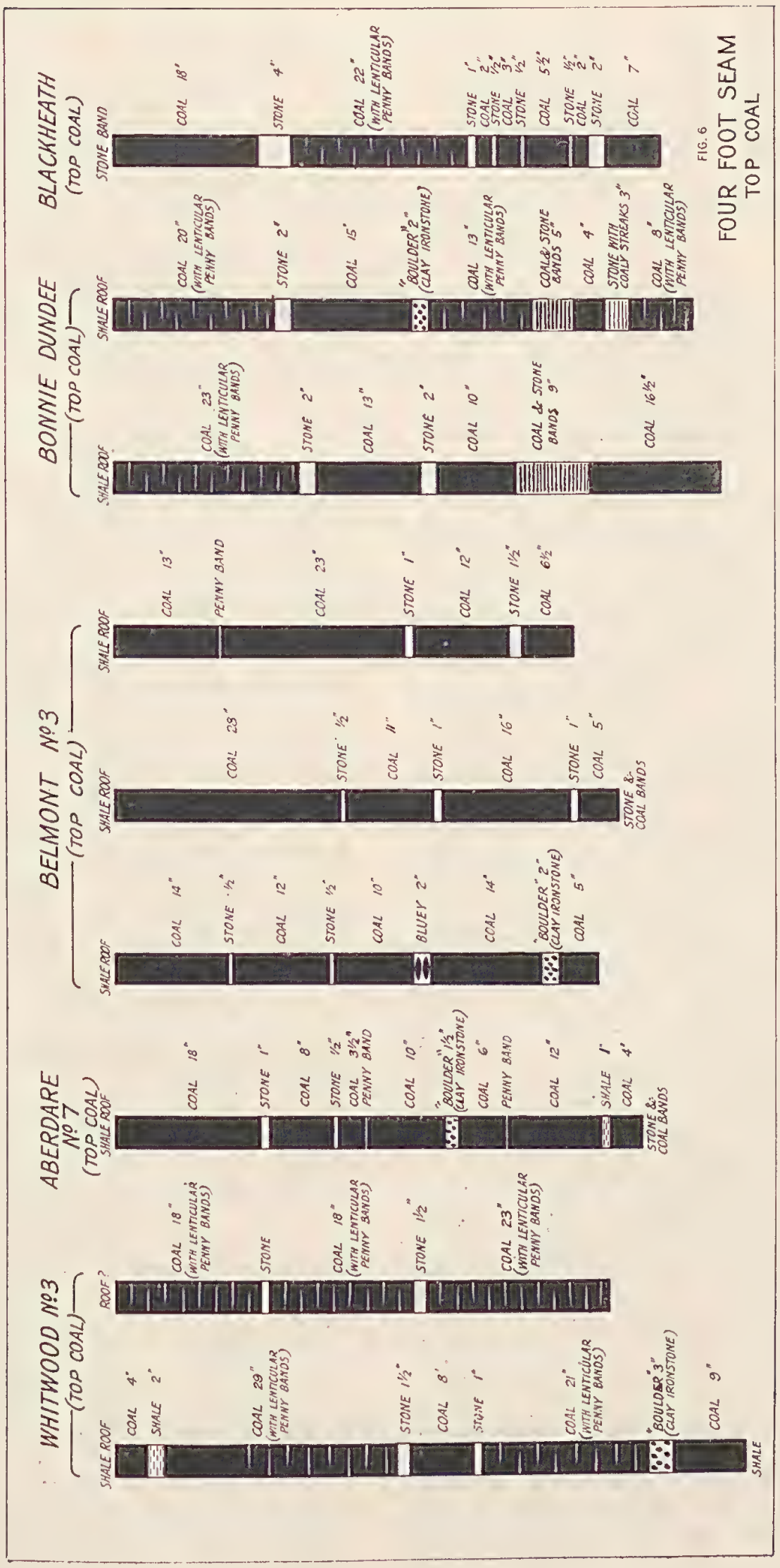


FIG 5

UNNAMED SEAM

BETWEEN BLUFF & FOUR FOOT


BONNIE DUNDEE
(TOP COAL)
SHALE ROOF
COAL 23" (WITH LENTICULAR PENNY BANDS)
STONE 2"
COAL 13"
STONE 2"
COAL 10"
COAL & STONE BANDS 9"
COAL 16½"
BLACKHEATH
(TOP COAL)
STONE BAND
COAL 18"
STONE 4"
COAL 22" (WITH LENTICULAR PENNY BANDS)
STONE 1"
COAL 2"
STONE ½"
COAL 3"
STONE ½"
COAL 5½"
STONE ½"
COAL 2"
STONE 2"
COAL 7"
SHALE ROOF
COAL 20" (WITH LENTICULAR PENNY BANDS)
STONE 2"
COAL 15"
"BOULDER" 2" (CLAY IRONSTONE)
COAL 13" (WITH LENTICULAR PENNY BANDS)
COAL & STONE BANDS 5"
COAL 4"
STONE WITH COALY STREAKS 3"
COAL 8" (WITH LENTICULAR PENNY BANDS)
FOUR FOOT SEAM
TOP COAL
FIG. 6
ELMONT Nº3
(TOP COAL)
SHALE ROOF
COAL 28"
STONE ½"
COAL 11"
STONE 1"
COAL 16"
STONE 1"
COAL 5"
STONE & COAL BANDS
COAL 13"
PENNY BAND
COAL 23"
STONE 1"
COAL 12"
STONE 1½"
COAL 6½"
WHITWOOD Nº3
(TOP COAL)
SHALE ROOF
COAL 4"
SHALE 2"
COAL 29" (WITH LENTICULAR PENNY BANDS)
STONE 1½"
COAL 8"
STONE 1"
COAL 21" (WITH LENTICULAR PENNY BANDS)
"BOULDER" 3" (CLAY IRONSTONE)
COAL 9"
SHALE
ABERDARE
Nº7
(TOP COAL)
ROOF ?
COAL 18" (WITH LENTICULAR PENNY BANDS)
STONE
COAL 18" (WITH LENTICULAR PENNY BANDS)
STONE 1½"
COAL 23" (WITH LENTICULAR PENNY BANDS)
SHALE ROOF
COAL 18"
STONE 1"
COAL 8"
STONE ½"
COAL 3½" PENNY BAND
COAL 10"
"BOULDER" 1½" (CLAY IRONSTONE)
COAL 6"
PENNY BAND
COAL 12"
SHALE 1"
COAL 4"
STONE & COAL BANDS
BELM
(TO
SHALE ROOF
COAL 14"
STONE ½"
COAL 12"
STONE ½"
COAL 10"
BLUEY 2"
COAL 14"
"BOULDER" 2" (CLAY IRONSTONE)
COAL 5"

Four Foot (New Chum) Seam.

Collieries:—Aberdare No. 6, *Coronation*, Rosehill*, Borehole*, Cardiff (United No.* 2)*, *Aberdare No.* 4*, *Bonnie Dundee No.* 2, *Blackheath, Noblevale No.* 1*, *Rhondda*, New Whitwood No.* 1 *Tunnel*, Whitwood No.* 4*, *Whitwood No.* 3*, *Rylance No.* 3 *(New Chum)*, Ebbw Vale*, Dinmore*, Aberdare No.* 5*, *Aberdare No.* 7, *Whitwood No.* 2*, *Whitwood No.* 1*, *Belmont No.* 3, *Noblevale No.* 2*, *New Aberdare East No.* 4 *(Verrall Estate)*.*

The seam was originally worked in the *Coronation, Rosehill,* and *Borehole Collieries* at Bundamba as Stafford's Four Foot Six Seam. These tunnels were soon abandoned in favour of the better class New Chum Seam, which was not then, or for a long time afterwards, recognised as identical with Stafford's Seam.

The Four Foot Seam lies from 52 ft. to 287 ft. below the Bluff Seam, but generally between 100 ft. and 200 ft. In the Dinmore district it consists of two workable sections separated by 12 to 15 ft. of alternating coal and shale bands and known respectively as the "Top Coal" and Bottom Seam or Main New Chum Seam. In the Bundamba district the "Top Coal" and most of the coaly measures between it and the main seam are missing. In *Bonnie Dundee No.* 2 and *Blackheath Collieries* the lower part of the section between the "Top Coal" and main seam carries two thick yellow stone bands, the lower of which has a leathery parting at its base. Two similar stone bands are present in the seam worked in *Noblevale No.* 1 (*No.* 3 *Tunnel*) the identity of which has always been in doubt; and, notwithstanding the apparent absence of both the "Top Coal" and the main seam (their places being occupied by sandstone and/or shale), the seam is regarded as a locally workable phase of the lower part of the "coaly measures" separating the two worked sections of the Four Foot Seam.

The "Top Coal" is much inferior to the main seam and has not been worked to anything like the same extent. Its thickness varies from 4 ft. 9 in. to 6 ft. 7 in. or more and averages about 5 ft. 9 in. It carries a number of inconstant shale bands varying in thickness from mere partings to two inches.

The main seam in the Dinmore district yields a coal of good to excellent quality, its main drawback being its tendency to fall to slack. The section usually worked varies from 2 ft. 2 in. to 4 ft. 9 in., the average being 3 ft. 9 in. to 4 ft. Immediately above this section there are two white stone bands each one to two inches thick and separated by one-half to two inches of coal. These two stone bands are remarkably constant and are regarded as of diagnostic importance. With the overlying band of somewhat inferior coal, which is usually about 14 in. thick, they are generally brushed for height in the haulage roads, but until recently were not mined. Three of the collieries now exploiting the seam, however, are mining the "brushing band" along with the main seam.

From Blackstone the Four Foot Seam has been worked almost continuously along the outcrop as far north as *Aberdare No.* 6 *Colliery,* beyond which it plunges beneath recent alluvium and Tertiary rocks and is not known to reappear. In the latter colliery the strike swings from North by West to North-West by West in sympathy with the swing of the Aberdare Seam in *Coolgardie Colliery.* This swing in the trend of the Four Foot Seam has an important bearing on the identity of the seams penetrated in the *Braeside* Shaft, and will be discussed in the section dealing with Bergin's Seam.

South-east of Blackstone the bottom half of the Four Foot Seam becomes very stony, limiting the workable section to two feet of medium quality coal below the two white bands. The outcrop of the seam swings across the Bundamba Anticline under the influence of a cross fold to *Bonnie Dundee No.* 2 *Colliery* and from there pursues a roughly northerly course through *Noblevale No.* 1 and *Rhondda* to *Whitwood* property where the strike changes to East-West. A succession of roughly East and West faults throws the seam down to the north and extends the area of the coal beyond the railway, its northerly outcrop being screened by a cover of Tertiary sediments. To the north-east this and the lower seams are truncated by the Ebbw Vale Fault. Approaching Six Mile Creek where it is crossed by the loop line the main Four Foot Seam thins out, and, in places, as in *Belmont No.* 3 *Tunnel,* disappears almost entirely, though the Top Coal is still present. East of Six Mile Creek the Top Coal appears to be eroded and even the main seam, which here carries a little coal, is washed out in places. The Four Foot Seam has not been found beyond the prospecting tunnel near the north-western corner of portion 285, Goodna (Verrall Estate).

The Four Foot Seam is worked in *Blackheath Colliery* close to *Bonnie Dundee No.* 2 boundary but further south the coal appears to die out, a borehole in portion 126, Bundamba, having penetrated over 400 ft. of strata below the Bluff Seam without intersecting more than a few thin streaks of coal. A seam of unknown thickness intersected in old *Bonnie Dundee* Shaft 200 ft. below the Bluff Seam may be the Four Foot. It has not been found south of this point. On the western limb of the anticline the Four Foot Seam has not been identified south of *Aberdare No.* 4 *Colliery* in portion 296, Goodna.

The Four Foot Seam is virtually worked out between Dinmore and *Bonnie Dundee No.* 2 *Colliery.* There are prosepects of moderately large reserves of medium grade coal in *Blackheath* and *Bonnie Dundee Collieries* and in the area between Blackstone and Bundamba.

* Abandoned.

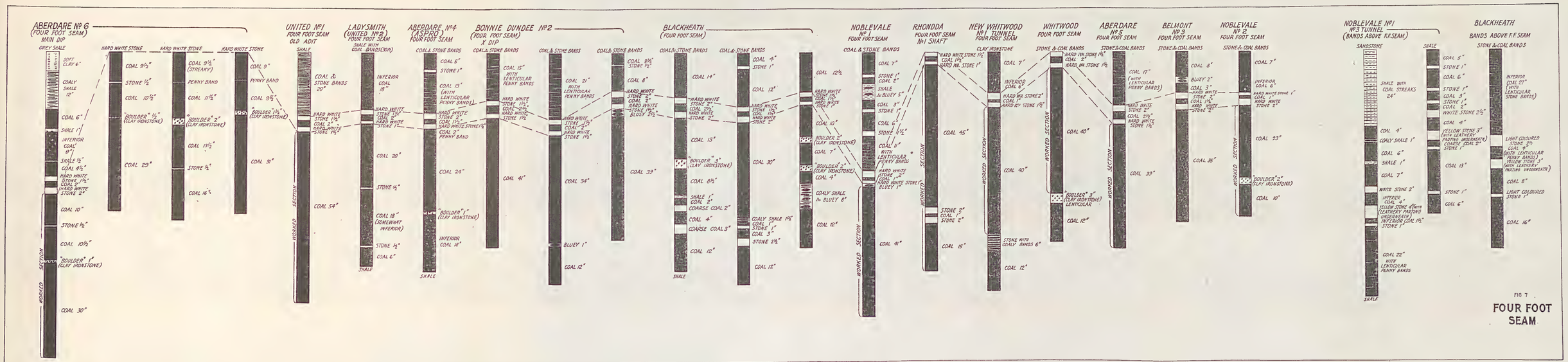


FIG 7

FOUR FOOT SEAM.

FIG. 8

BERGIN'S SEAM

Bergin's ("Seventy-Foot") Seam.

Collieries:—Aberdare No. 8, Coronation, ?Borehole*, Rosehill*, Bonnie Dundee No. 2, Rhondda, Belmont No. 2*, Noblevale No. 2*, New Aberdare East No. 3, Whitwood No. 4*, Whitwood No. 3, Rylance No. 3*, Amberley No. 3.*

Like the Four Foot Seam the Bergin's Seam was originally worked along the outcrop on the right bank of Bundamba Creek between Blackstone and Bundamba but proved to be rather inferior, and the workings upon it were not extensive. The exploitation of the seam in the collieries about Dinmore came much later.

The Bergin's Seam lies from 18 in. to 70 ft. or more below the Four Foot Seam. The strata usually separating the two seams are shale and sandy shale, but in the northern part of *Rhondda* and the southern part of *Whitwood Collieries* a lens of sandstone with a maximum thickness of 60 ft. comes in.

The working section of the coal varies from 3 ft. 10 in. to 14 ft. In *Rylance No. 3, Whitwood No. 3,* and *Rhondda Collieries* the seam has been worked in two sections of from 5 to 7 ft. It carries numerous inconstant bands of stone up to 2½ in. in thickness. Throughout the *Rylance No. 3* workings the Bergin's Seam is only 18 in. below the Four Foot Seam and is separated therefrom by alternating coal and stone bands. It is not acknowledged as the Bergin's Seam and has been given a separate name—"Underbands"—the seam next below it being called the Bergin's. There is no doubt, however, that the "Underbands" is identical with the seam worked in *Whitwood No. 3* and *Rhondda Collieries* as the Bergin's. The identity of this seam with the original Bergin's Seam at Bundamba cannot be regarded as finally established because it has not been traced cotinuously in the field; but there seems no reason to doubt it, as in both areas it is the next seam below the Four Foot.

In *Bonnie Dundee No. 2 Colliery* the Bergin's Seam is only slightly more than 4 ft. thick. This section is so thin as compared with the section of the seam in *Rhondda* and collieries further north, that the possibility that the seam is split by a wedge of shale cannot be ruled out. The prospecting of the strata underlying the Bergin's Seam in *Bonnie Dundee No. 2* property has not been carried sufficiently far to place the matter beyond dispute.

The Bergin's Seam has been found in a prospecting shaft in the northern end of portion 129, Bundamba, but, with this one exception, neither the Bergin's Seam nor any of the lower seams, has been identified beyond the southern boundary of the parish of Goodna. A number of inferior seams do occur there but it has not been found possible to correlate them with the named seams.

Braeside No. 1 shaft in portion 159, Goodna, is reported to have intersected four seams. W. E. Cameron (1899) stated that the uppermost seam, No. 1, was generally supposed to be identical with Bergin's Seam. It followed that Nos. 2, 3, and 4 Seams were respectively identified as the Striped Bacon, Rob Roy, and Dobbie's Seams. Mr. Cameron accepted this correlation but subsequently changed the name of Dobbie's Seam to "Lindsay's Hard" Seam, as Braeside No. 4 Seam was called, or simply the Hard Seam. Mr. Cameron's 1923 map shows the Hard Seam swinging sharply to the north-east in the south-west corner of portion 244. My own observations showed the strike of the seam in an old tunnel in the south-east corner of portion 159 to be almost at right angles to that indicated by Mr. Cameron. The crop of this seam appears to go in the direction of *Braeside No. 1* Shaft and it is considered to be Braeside No. 1 Seam. The Braeside Fault lies somewhere between the tunnel and the shaft but as, according to Cameron (1899), the throw on the fault hereabouts is only ten feet, it cannot materially affect the course of the seam.

The identity of the seam in portion 159 is not altogether certain, but, making allowance for the probable shifting of the outcrops of the seams by the Coronation Fault, it may very well be the Rob Roy Seam. The seam shown on Cameron's 1899 map as Doby's (*sic*) is believed to be one of the lower Braeside seams, perhaps No. 3, on the south or downthrow side of the Coronation Fault.

As previously stated, the Four Foot Seam in the deeper workings of Aberdare No. 6 Colliery shows a pronounced bending towards the west. By projecting this seam from the deeper workings its outcrop would be approximately 25 chains (measured parallel with the dip) from the crop of Braeside No. 1 Seam. Allowing a dip of one in five the two seams are estimated to be well over 300 ft. apart. When it is remembered that the Bergin's Seam is not known to be more than 80 ft. below the Four Foot Seam, and usually rather less, the impropriety of correlating Braeside No. 1 Seam and the Bergin's Seam becomes apparent.

Thus, although the identity of the Rob Roy Seam and the Braeside No. 1 Seam can hardly be claimed to have been established, it is plain that the latter is on a very much lower horizon than that usually attributed to it. At the present stage of our knowledge the correlation now suggested seems the most probable.†

In the Dinmore district the Bergin's Seam has been extensively worked, though there are believed to be considerable reserves in the eastern portion of *Whitwood Colliery.* It is reported to occur in a workable condition under the Four Foot Seam over a fairly large area in *Noblevale No. 1 Colliery,* but as

* Abandoned.

† It was subsequently proved by diamond drilling that the Braeside Fault had a very much greater throw than Cameron had supposed. It is now established beyond question that Braeside No. 1 Seam is the Bergin's Seam.

the two seams are only a few feet apart and the latter was on fire in several places when the pit closed down, there is not much hope that it will ever be worked on a large scale here.

Striped Bacon (Strip of Bacon) Seam.

Collieries:—*Coronation**, *Rosehill**, *Borehole**, *Rhondda*, *Whitwood No.* 3, *Rylance No.* 3, *Noblevale No.* 2*, *Belmont No.* 2*, *New Aberdare East No.* 1 *Tunnel**.

This seam, usually spoken of as the "Strip of Bacon," was, like the Bergin's and Four Foot, originally opened up at Bundamba, but these tunnels were soon abandoned and the seam remained undisturbed for many years until it was finally worked, though apparently on a small scale, in *New Chum Colliery*. It is now being extensively worked in *Whitwood No.* 3 and *Rhondda Collieries*.

The Striped Bacon Seam, which usually lies about 60 ft. below the Bergin's Seam, is a banded seam with a working section varying from 3 ft. 8 in. to 6 ft. 4 in. and averaging perhaps 5 ft. to 5 ft. 6 in. In *Rhondda Colliery* it carries as many as eleven bands of stone (including "bluey" and "boulder") from one-half inch up to four inches thick. The majority of the stone bands are lenticular and non-persistent.

The seam may be traced by old workings from portion 162 to portion 173, parish of Goodna. The prospecting shaft on the seam in portion 295 shown on Mr. Cameron's 1923 map could not be located. The seam has not been identified further south on either limb of the Bundamba Anticline.

A seam of coal which occurs 50 ft. below the Bergin's Seam in *Bonnie Dundee No.* 2 *Colliery* may be the Striped Bacon, or it may be a split portion of the Bergin's Seam. A banded seam recently opened in *Noblevale No.* 1 *Colliery* (*No.* 4 *Tunnel*) is regarded by some as the Striped Bacon Seam, but as it is some 230 ft. below the Bergin's Seam the correlation is open to doubt.

The Striped Bacon Seam underlies an extensive area in the Dinmore district but only outcrops towards Riverview, where it has been worked in *Noblevale No.* 2, *New Aberdare East No.* 1, and in *Belmont No.* 2 *Collieries*. It appears to become inferior north of the railway (in *Dinmore Colliery*) while in the Verrall Estate beyond *New Aberdare East No.* 1 it is badly banded and not workable.

There are still considerable reserves of coal in this seam in the Dinmore area, but it all requires washing, as the stone bands are too numerous to exclude in mining. It is difficult to assess the prospects of the seam in the Bundamba district, as only one exposure was examined. This showed a section three feet eight inches thick of quite fair quality coal, and moderate reserves may reasonably be anticipated.

Rob Roy Seam.

Collieries:—*?Coronation**, *Rosehill**, *Borehole**, *?Eureka**, *Rhondda*, *Rylance No.* 3, *?Dinmore**, *Amberley No.* 3.

The Rob Roy Seam was worked many years ago at Bundamba but these tunnels were soon abandoned, and the seam received no attention until comparatively recently when it was exploited in *Rylance No.* 3 *Colliery* and later in *Rhondda*.

The perpendicular distance between the Rob Roy and Striped Bacon Seams is usually about 50 ft. but in *Rylance No.* 3 it is reported to be as much as 110 ft.

In the Dinmore district the working section varies from 5 ft. 3 in. to 7 ft. and averages perhaps 6 ft. 3 in. The coal is somewhat superior in quality to that of the Striped Bacon Seam and generally stone bands are less frequent. The stone bands are mostly lenticular but there is a consistent "badger" in the middle of the seam in *Rhondda* and *Rylance* workings. The seam is not at present visible in the Bundamba district nor have any of the old tunnels on it been positively identified.

The possible identity of the Braeside No. 1 and Rob Roy Seams has already been discussed. The former will be described under the heading "Braeside No. 1 Seam" (below).

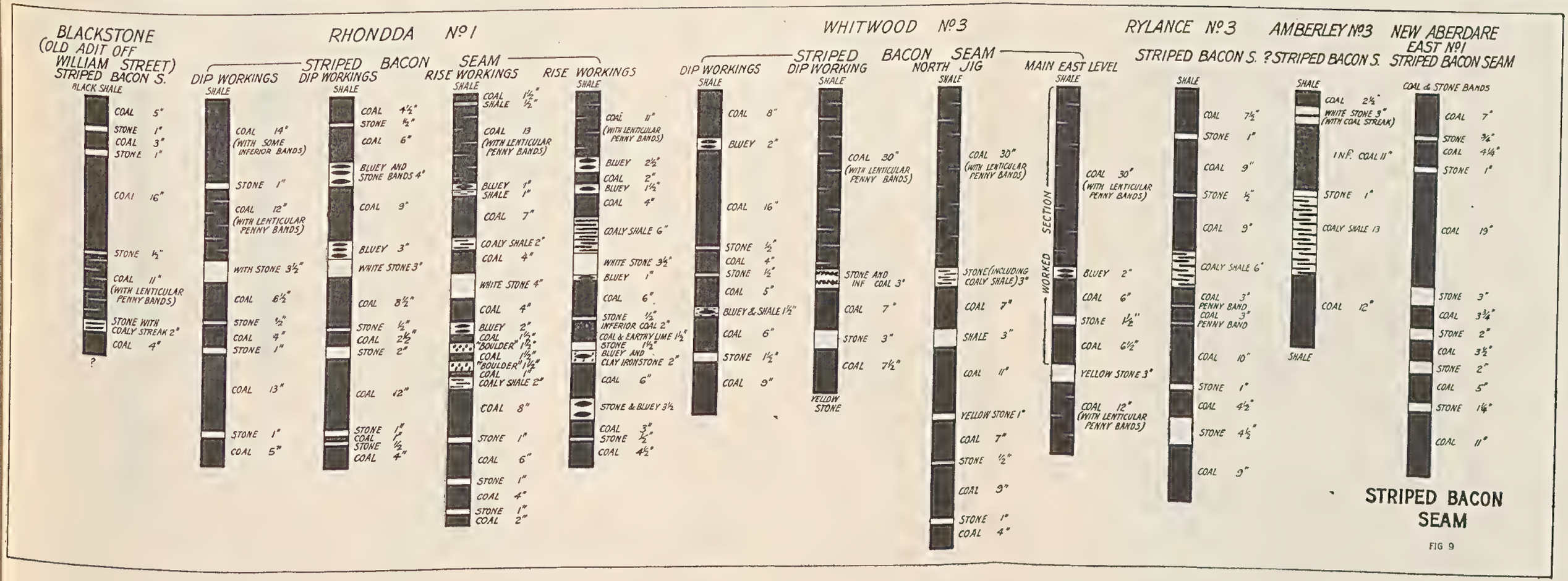
It is expected that the Rob Roy Seam will be found to underlie the whole of the New Whitwood Company's property, the greater part of the *Rhondda* property, and perhaps part of *Noblevale No.* 1. It does not appear to be workable in the Verrall Estate, but there are prospects of moderate reserves about *Belmont* and *Whitwood No.* 4 *Collieries*. Prospects in the Bundamba district are doubtful, though Gibb Maitland (1896) records that the seam was 6 ft. thick in the Borehole property.

Braeside No. 1 Seam.

Collieries:—*?Wallsend**, *?Speedwell**, *Braeside**.

Braeside No. 1 Seam was passed through at a depth of 15 ft. in *Braeside No.* 1 *Shaft* but it was worked from a tunnel driven through the overlying shales west of the shaft. It was also worked from a tunnel driven on the outcrop west of *Braeside No.* 3 *Shaft*. The long-abandoned *Wallsend* and *Speedwell* Tunnels were driven on the outcrop of a seam north of the railway which has been mapped as Braeside No. 1. The crop of No. 1 Seam is visible in portion 246, not far from *New Ebbw Vale No.* 1 *Tunnel* and in portion 222 further west. As exposed in *Braeside No.* 2 tunnel (west of *Braeside No.* 3 (*Enterprise*) Shaft), Braeside No. 1 Seam is 4 ft. thick and includes six thin shale bands. It has not been traced south of Braeside No. 1 Shaft but it is possibly identical with the Rob Roy Seam.

* Abandoned.



STRIPED BACON SEAM

FIG 9

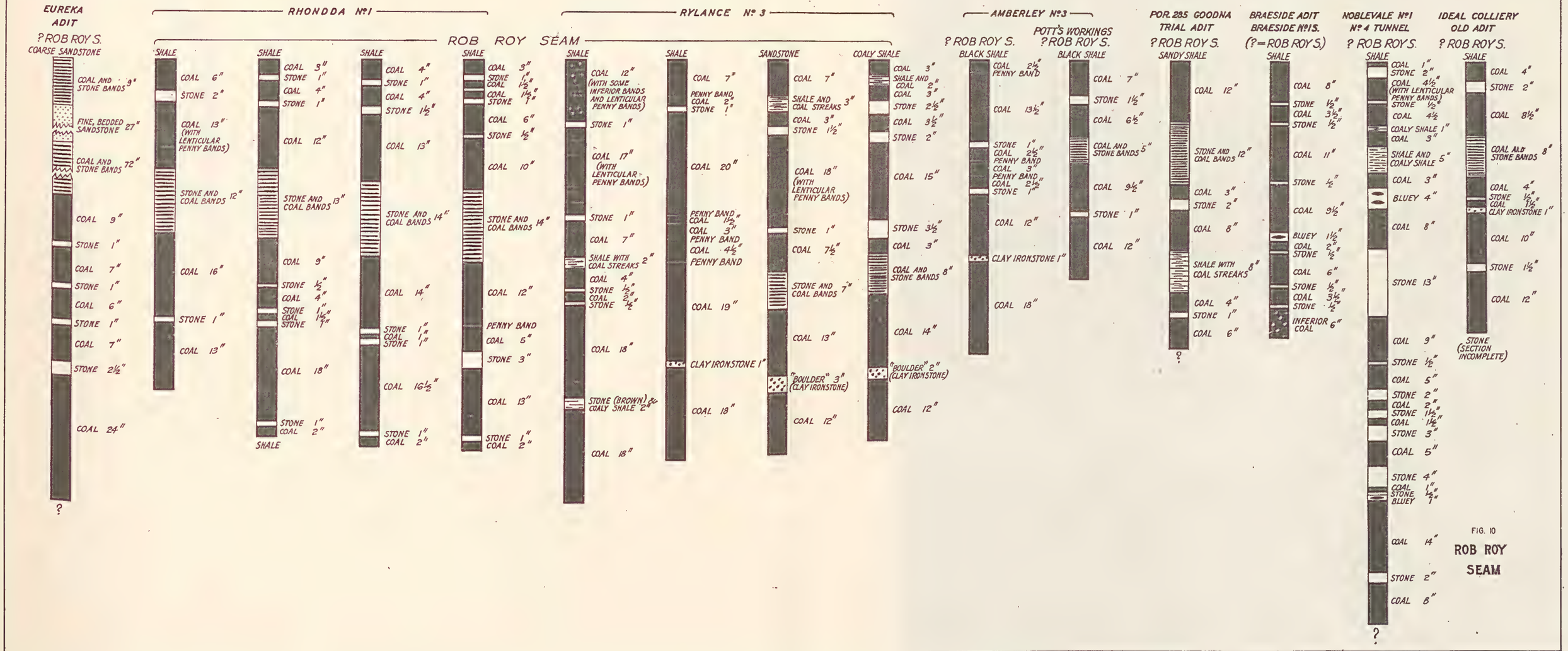


FIG. 10

ROB ROY SEAM

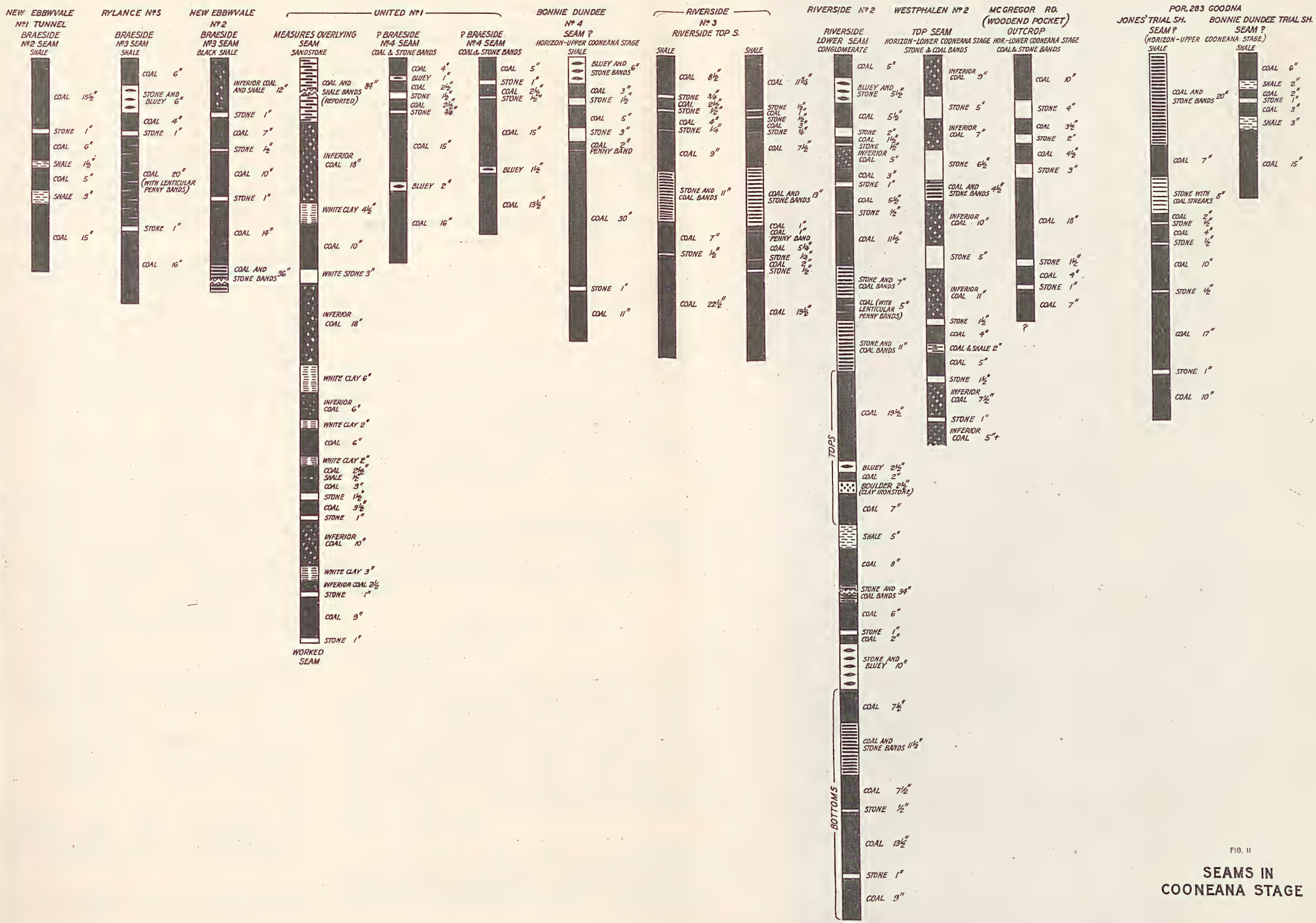


FIG. 11

SEAMS IN COONEANA STAGE

Redbank Seam.

Colliery:—Redbank (New).*

The *Redbank Colliery* is now abandoned and the shafts are flooded. Hence it was not possible to examine the seam. Furthermore there is no published account of the colliery or of the coal worked in it. There is, however, in the records of the Geological Survey a MS. section, prepared by Mr. J. H. Reid of the Geological Survey of Queensland, which shows a seam 50 ft. thick with three workable sections with respective thicknesses of 8 ft. 9 in. (with three stone bands), 6 ft. 9 in. (with two stone bands), and 5 ft. 8 in. (with one stone band). The balance of the seam is made up of banded coal. The thickest shale band is 1 ft. 9 in. thick, but above the bottom section there is a lenticular sandstone bed from 2 in. to 20 ft. thick.

The stratigraphic position of this seam is doubtful. If there is no major faulting between the *Redbank Colliery* and Verrall Estate the mapping would indicate an horizon at or near the base of the Blackstone Stage though no section comparable with the large composite Redbank Seam is known at Bundamba or Dinmore. The outcrop of the Redbank Seam has not been identified. Possibly the large, steeply dipping crop exposed in the cutting on the loop line immediately north of the Brisbane Road, but not seen elsewhere, may be a part of it.

Braeside No. 2 Seam.

Collieries:—Braeside, New Ebbw Vale No. 1*.*

This seam was worked from Braeside No. 1 Shaft. R. D. Graham (1898) gives the thickness here as seven feet, but, according to Fryar (1900), it was only three feet. The crop of the seam is well exposed in a shale quarry in portion 223, Goodna, where it is 4 ft. 6 in. thick. From here it may be traced at intervals to *New Ebbw Vale No. 1 Tunnel* in portion 246 where it was worked to a small extent. The working section was 3 ft. 11 in. thick, including 5½ inches of stone in three bands. The coal is hard and of inferior quality.

Braeside No. 2 Seam has not been recognised beyond the limits above referred to, but it may quite well be identical with one of the seams exposed further south in portions 161 and 162.

Braeside No. 3 Seam.

Collieries:—Braeside, Rhondda No. 3 (Enterprise)*, New Day Dawn (Blackball)*, Stafford's Tunnel.*

Braeside No. 3 is the most extensively worked of all the Braeside seams. There is no accesss to the seam in the old *Braeside Colliery*. In *"Blackball"* it has a working section of 2 ft. 9 in. and includes two stone bands.

The crop in portion 240 on which a tunnel has been driven, and which is shown on Mr. Cameron's 1923 map as the Striped Bacon (No. 2) Seam, is believed to be No. 3 Seam. The crop can be seen again at the entrance to *"Blackball" Tunnel* and the course of the seam can be traced thence in a general easterly direction by old tunnels to portion 256, where Stafford Brothers worked it fifty or more years ago. In *Stafford's Tunnel* the seam had a working thickness of 3 ft. 6 in. but Messrs. Rylance, who have recently reopened the pit, now propose to take down a six-inch stone band in order to work a six-inch section of very good coal above it. I have not been able to identify No. 3 Seam south of the Braeside Fault but I have no doubt that it exists there, possibly as a workable seam. Perhaps it is one of the seams worked in the eastern part of portion 161.

Braeside No. 4 (Lindsay's Hard) Seam.

Collieries:—Braeside, Day Dawn*, ?United No. 1.*

No. 4 Seam is separated from No. 3 by 135 ft. of strata, including some fifty feet of coarse pebbly sandstone. It does not appear to have been extensively worked.

The seam is nowhere completely exposed. Fryar (1900) gives its thickness as 3 ft. 6 in. including eight inches of coarse coal and two stone bands, and reports the coal to be exceptionally good but very hard. In an old tunnel in portion 246, No. 4 Seam is overlain by twelve feet of coal and stone bands, and in this respect it resembles the seam worked in *United No. 1 Colliery*. No. 4 Seam has not been traced south of the Braeside Fault or east of the tunnel in portion 246.

The Braeside seams appear to be of very restricted distribution, at least as workable seams. A number of seams have been mapped or recorded elsewhere in the Cooneana Stage, but none of them has been extensively worked. The correlation of the various isolated occurrences has not been attempted.

Riverside No. 1 Seam.

Collieries:—Riverside No. 1, Riverside No. 3, ?Prior's Pit*, ?Moggill*.*

The stratigraphical position of the seams worked in the several pits in the Moggill district has not been accurately established. The uncertainty may be ascribed to their isolated situation with respect to seams whose horizons are known, to the changing nature of the sedimentation approaching this area, and to the dissimilarity of the coal sections from those of known seams. They appear to lie below the Rhondda Stage but above the presumed extension of the Garden Seam, and they are tentatively placed in the Cooneana Stage.

Riverside No. 1 Seam was originally worked from a tunnel in the eastern side of the Moggill Pocket, and subsequently from a tunnel further west. The seam worked in *Prior's Colliery* in portion 132,

* Abandoned.

Moggill, and also that worked in the old *Moggill* pit, both of which are reported to carry a twelve-inch stone or "badger," may be identical with it.

The worked section of the seam is 5 ft. 6 in. thick, including a "badger" one foot thick and three constant, and one or two lenticular, stone bands.

Riverside No. 2 Seam.

Colliery:—*Riverside No.* 2.

Two sections of this 18 ft. seam have been worked. Stone bands are present throughout the section. No. 2 Seam may be identical with the seam in Lyons' old shaft in portion 117, Moggill.

The top section, which alone is being worked at present, is 2 ft. 9 ins. thick with a lenticular band of "bluey" and two or three penny bands. The bottom section, previously worked to a small extent, is 4 ft. 2 in. thick but it includes a twelve-inch "badger" and two stone bands.

The coal in No. 2 Seam is rather inferior to that in No. 1 Seam. The perpendicular distance between Nos. 1 and 2 Seams is estimated to be 110 ft. The intervening strata comprise massive sandstone and shale bands.

Riverside No. 3 Seam.

Collieries:—None.

This seam has been prospected by a shaft near No. 2 Tunnel and has not been examined by the writer. The section quoted by the manager of No. 2 Tunnel indicated a seam some 13 ft. thick with one or possibly two, workable sections. The bottom three feet of the seam contains four stone bands aggregating 4½ in. in thickness.

Garden Seam.

Collieries:—*Abermain**, Tunnel in portion 169, Chuwar (Tivoli Hill)*.

The Garden is the uppermost of the worked North Ipswich seams. Actually there is a seam overlying the Garden Seam which has been prospected and reported to have been worked to some extent (though I could obtain no confirmation of this). The Garden Seam was worked from a number of tunnels in Abermain Estate to a reported distance from the outcrop of 250 yards. There is also an old tunnel on the seam in portion 169, Chuwar, which seems to have been included in Gulland's original Tivoli Estate. The seam has been traced from Section XXXVII., where its crop shows on the right bank of Tivoli Creek, to portion 44 where the seam is now exposed in the old Waterstown clayhole. South-west of Section XXXVII. the outcrop is screened first by built-up ground and then by the recent alluvium which covers most of the Railway Workshops Reserve. Going east from Abermain Estate the Garden Seam probably follows the course of the Bremer River, more or less closely, as far as portion 7, Chuwar, where the river runs northward. Possibly one of the seams prospected recently in portion 33, Goodna, is the Garden Seam. The sharp bending of the strata to the north-east will carry the seam (if it still continues) to the north side of the river, somewhere about portion 32 or 31. No seams, however, have been recorded on the north side of the river hereabouts.

No section of the Garden Seam was available for examination, but Fryar (1900) states that the worked section was 3 ft. 6 in. thick and that it was "not altogether free from bands of shale."

The Bremer Basin Coal Company in 1886 sank a shaft in portion 72 (or 71), Ipswich, on the south bank of the Bremer River, to an unknown depth. Cameron (1899) states that a seam of coal of inferior quality, which he presumed to be the Garden, was intersected, but there was some confusion as to the depth, one authority (Surveyor R. D. Graham) putting it at 150 ft. and another at 300 ft. By my calculation the Garden Seam should be 380 ft. below the surface at the Bremer Basin shaft, and there is no certainty that the seam met with, even assuming it occurred at the greater depth, was the Garden Seam.

Tantivy Seam.

Collieries:—*Tantivy**, *Abermain**, *?Haighmoor**.

The Tantivy Seam lies about 100 ft. below the Garden Seam, the intervening strata being shale. The seam has been worked only to a slight extent.

No section of the Tantivy Seam is now visible but Mr. C. L. A. Brown, who worked in the *Tantivy Colliery*, states that the working section was 3 ft. 4 in. thick including two stone bands. Lying over this section there was a ten-inch stone (coaly shale) band and then eighteen inches of somewhat inferior coal which, when brushed for height in the wheeling roads, was usually sent to the market.

The Tantivy Seam can be traced from portion 81 to portion 78, a distance of half-a-mile. It is possible that the seam lying above the two seams intersected in *Haighmoor* Shaft, and worked independently by two tunnels from the outcrop, may be identical with the Tantivy Seam.

Fiery Seam.

Collieries:—*Abermain**, *?Haighmoor*.

The Fiery Seam lies 200 ft. or more under the Tantivy Seam. It was intersected in Abermain Shaft at a depth of 250 ft.† and is reported to have been worked to a small extent. Its outcrop may be seen in a cutting at the intersection of Liverpool Street and the Mount Crosby railway. There is a fine exposure in a recent washout in portion 72, Chuwar at a place where its course is interrupted by a fault. The seam is at least 20 ft. thick here but does not show a workable section. Going east a section at the top of the seam some 2 ft. 9 in. thick is split off

* Abandoned.

† Given as 270 ft. on Cameron's 1899 map.

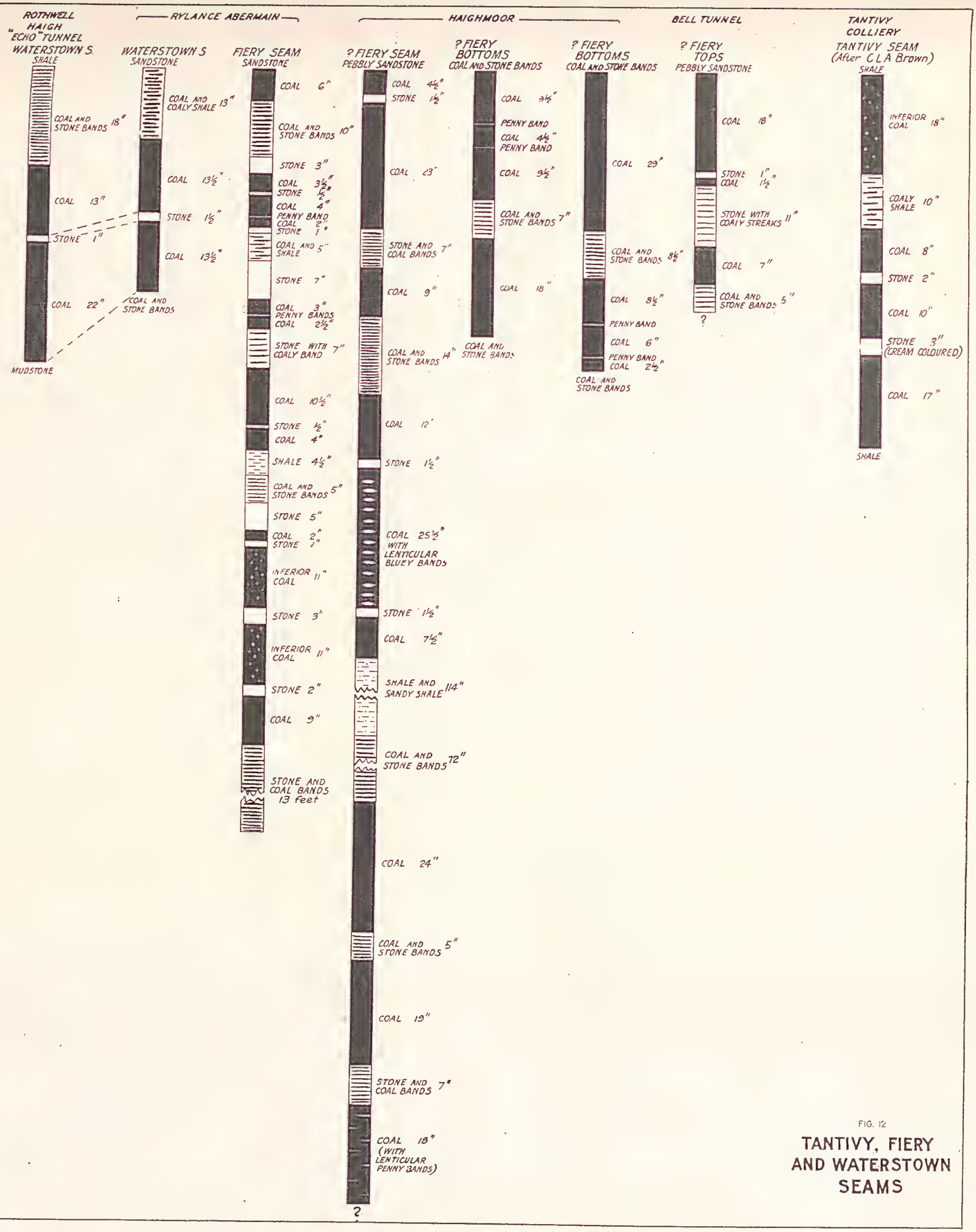


FIG. 12

TANTIVY, FIERY AND WATERSTOWN SEAMS

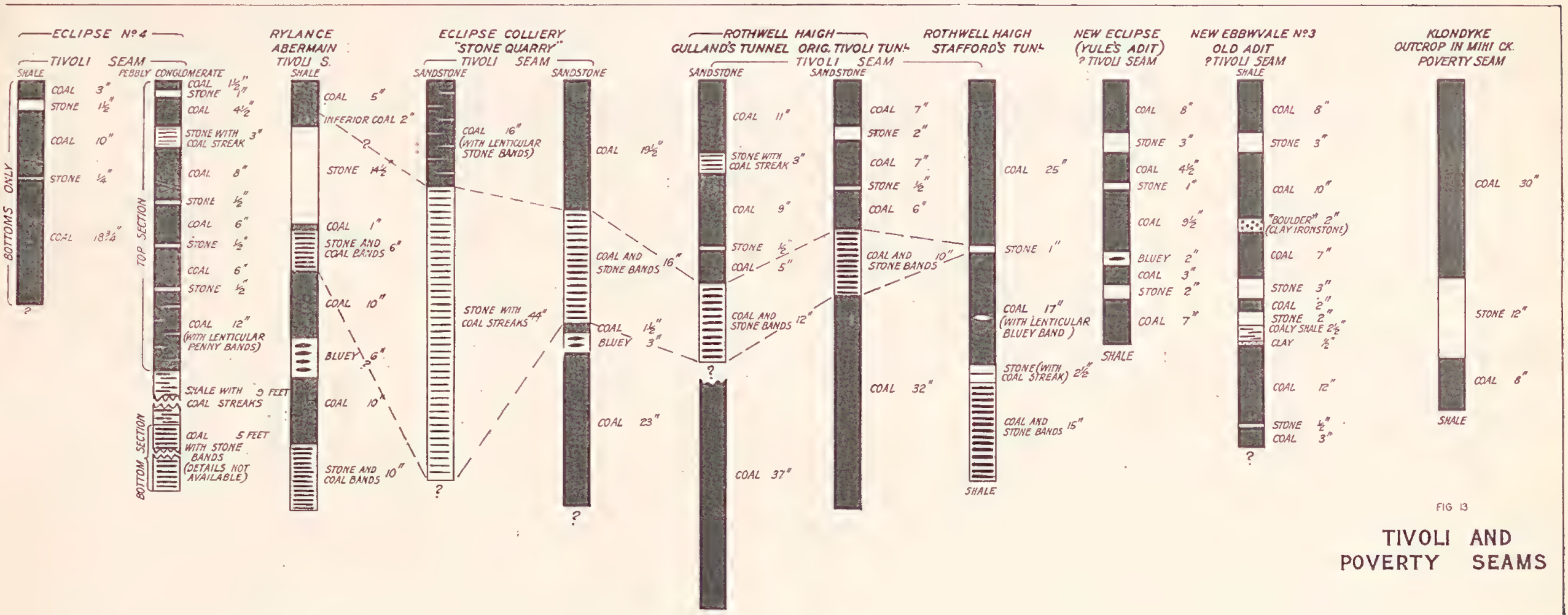


FIG 13

TIVOLI AND POVERTY SEAMS

by a wedge of shale and sandy shale which grows rapidly. Both crops are soon lost and do not again reappear in natural exposures. *Rylance Abermain Tunnel* in portion 39 entered the seam 24 yards from the entrance. The seam here is 23 ft. thick and is made up of a succession of coal and stone bands without a workable section. The late Mr. A. Wright, who spoke from a very long acquaintance with the Tivoli district, insisted that the Fiery Seam was not seen in the shaft sunk by the Abermain Company to the Waterstown Seam in portion 41 though the crop used to be visible in College's Crossing Road only ten chains away. If this is correct the seam must be washed out locally, for the plans show no faulting in the Waterstown Seam hereabouts. On stratigraphic evidence the two seams met with in *Haighmoor* Shaft are tentatively regarded as split sections of the Fiery Seam. The upper seam closely resembles the split section of the Fiery Seam in portion 72.

The seam has not been traced beyond the limits already mentioned. West of Sandy Creek the seam is not promising but in the Haighmoor area present appearances presage large reserves.

Waterstown Seam.

Collieries: — *Abermain**, *Eclipse**, *Rothwell Haigh**, *?Liverpool**.

The Waterstown Seam has been extensively worked between Sandy and Tivoli Creeks but, with the possible exception of a seam formerly worked in the old Liverpool Estate (portion 103), it has not been traced beyond these limits. It lies some fifty feet below the Fiery Seam (56 ft. in *Rylance Abermain Tunnel*), the intervening strata being shale and thin sandstone beds.

The thickness of the seam varies a good deal. In *Waterstown* (afterwards *Abermain*) *Colliery* the seam was as much as 3 ft. 6 in. thick in the western levels but beyond the Tivoli Fault it narrows, and in *Rylance Abermain Tunnel* it is only 2 ft. 5 in. Where examined by me the seam carries only one stone band but Cameron's section (1899) shows two bands. The coal is a grand steam coal and makes excellent coke.

So far as can be learned the coal does not seem to have exhibited any marked deterioration in Gulland's old workings (*Rothwell Haigh*). I consider the seam, though small, offers good inducement for further prospecting both to the west and to the dip of existing workings.

Unnamed Seam Above Tivoli Seam.

Colliery:—*Liverpool**.

In *Klondyke Colliery* two seams of coal have been worked, the lower of which may safely be correlated with the Eclipse Seam. Ninety feet above the Eclipse they have worked a second seam which they call the Top Seam and which is usually correlated with the Tivoli Seam. Fifteen feet above the Top Seam, and separated from it by shale and pebbly conglomerate, is a third seam not yet worked. Assuming that the Top Seam is the Tivoli, the third seam must be a new seam not recorded in Abermain Shaft. It can be traced with reasonable certainty to the *New Eclipse* (formerly *Liverpool*) *Colliery*, where it seems to have been worked to a small extent in the early days of the field. Here it lies 40 ft. above the Klondyke Top Seam.

At *Klondyke* the seam is about 4 ft. thick and, judged by the weathered coal at the outcrop, is likely to be of workable quality.

Tivoli Seam.

Collieries:—*Eclipse No. 4**, *Eclipse**, *Abermain**, *Rothwell Haigh*, *New Eclipse**, *Klondyke**.

The Tivoli Seam lies 225 ft. stratigraphically below the Waterstown Seam in *Rylance Abermain Tunnel* (250 ft. in Abermain Shaft). It has been worked extensively in *Abermain* and *Rothwell Haigh Collieries* where the worked section was four to five feet thick and included two stone bands. North-east of the Tivoli Fault the lower stone band thickens rapidly and the coal begins to deteriorate in quality. Approaching Sandy Creek the seam became unworkable. On the other side of Sandy Creek (north-east of the Boxwood Fault) the seam is split into two sections separated by ten feet of coaly shale. The sections are each about three feet thick and both have been worked to some extent.

The seam does not appear to have been worked far beyond (south-west of) Gulland's Fault in *Rothwell Haigh Colliery* and its continuity with the lower seam in *New Eclipse Colliery* has not been definitely established. Hence the correlation of the New Eclipse lower seam, of the Klondyke Top Seam, and of the upper seam in *New Ebbw Vale No. 3 Colliery* with the Tivoli Seam is to be regarded as tentative.

The Tivoli Seam in *Rothwell Haigh* and *Abermain Collieries* yielded a very fine steam and coking coal; and it is not surprising to find that it was worked to a greater depth than any other seam except the Aberdare. The condition of the seam at the lowest working faces is not recorded but old miners say the coal showed no deterioration. There seems no reason why the seam should not be exploited to a very much greater depth.

Poverty Seam.

Collieries:—Nil.

Between the Eclipse Seam and the Top Seam in *Klondyke Colliery* there is a seam of coal with a maximum thickness of 30 inches. The quality of the coal is reported to be excellent; and, as the roof is of coaly shale and easily brushed, it is proposed to work the seam, a new tunnel having been started for this purpose. A section of the seam partially

* Abandoned.

FIG 14

ECLIPSE AND BENLEY SEAMS

exposed in the new tunnel showed twenty inches of coal with one stone band. The coal was badly weathered and its quality could not be judged.

This seam, known as the Poverty, lies 50 ft. above the Eclipse. It has not been seen outside the limits of the *Klondyke Colliery.*

What is believed to be the outcrop of the Poverty Seam is exposed in Mihi Creek three chains up from its confluence with the Bremer River. The crop is 2 ft. 6 in. thick.

Eclipse Seam.

Collieries:—Eclipse No. 2, *(Donnybrook)*, Nil Desperandum*, Eclipse* (including old *Bishop Colliery)*, Boxwood*, Rylance Abermain, Abermain*, Rothwell Haigh*, Klondyke, New Ebbw Vale No.* 3 *(Woodend).*

In *Rylance Abermain Tunnel* the Eclipse Seam lies 104 ft. below the Tivoli Seam, the intervening strata being chiefly shale with one bed of sandstone 20 ft. thick. The seams are reported to be 75 ft. apart in Abermain Shaft and 130 ft. in *Rothwell Haigh Colliery.*

The Eclipse is the most extensively worked of the North Ipswich seams. It has been traced from portion 1, Chuwar (at the corner of College's Crossing Road and The Junction Road), to Harlin Road, Woodend Pocket, a distance of three-and-a-half miles. At the latter locality the seam is truncated by the West Ipswich Fault. It has been worked at intervals between here and the Boxwood Fault near Sandy Creek, but east of the Boxwood Fault the quality of the coal is inferior and the seam has not been worked.

The section of the Eclipse Seam usually worked is some five feet thick with a band of stone or "badger" four to six inches thick. This section is sandwiched between two sections of somewhat inferior coal two feet or more thick, known respectively as the "Dirty Tops" and "Dirty Bottoms." Generally speaking the "Dirty Tops" are of a better quality than the "Dirty Bottoms" and they are now being worked in *Klondyke* and *New Ebbw Vale No.* 3 *Collieries.* All three sections were worked in the old *Boxwood* and *Eclipse No.* 2 *(Donnybrook) Collieries.*

The quality of the coal in the Eclipse Seam exhibits considerable variation within the worked area. Between the Boxwood and Tivoli Faults the coal is a first rate steam and coking coal, but in the whole of the worked area in the *Rothwell Haigh* and *Abermain Collieries* the coal is reported to have been more or less inferior, deteriorating in depth. In *Klondyke* and *New Ebbw Vale No.* 3 *Collieries* the coal is moderately good.

The crop of the Eclipse Seam has not been traced between Pine Mountain Road and Gulland's Fault in portion 71 though a small amount of prospecting has been carried out. There is some reason to believe that the seam becomes stony at the outcrop southwest of *Rothwell Haigh,* but it is worth testing at deeper levels by diamond drilling.

For some reason the Abermain Company only worked the Eclipse Seam to a very small extent north-east of the Tivoli Fault even though the quality of the coal had been proved to be good. Its exploitation is now being commenced by Messrs. Rylance Collieries and Brickworks Pty. Ltd. East of the Boxwood Fault the seam progressively deteriorates, until, in portion 175, it consists only of carbonaceous shale with thin coal bands. The seam has not been identified east of this point. In depth the Eclipse Seam offers excellent prospects for a company with a strong financial backing, more particularly in the area between the Boxwood and Tivoli Faults.

Francis' Seam.

Colliery:—Klondyke.*

In *Klondyke Colliery* a small seam of good coal lies 100 ft. below the Eclipse Seam. As exposed in a trial tunnel in a gully north of *Klondyke No.* 1 *Tunnel* the seam is 2 ft. 1 in. thick. There is a stone band one inch thick four inches from the roof and it is understood that Mr. Paul Francis, who worked the seam to a small extent, only took out the coal below this band. The crop of the seam can be seen at the intersection of the Toowoomba Road and Waterworks Road, but it has not been traced beyond (north-east of) that point.

Benley Seam.

Collieries:—Tunnel in portion 132*, *Bindley*, Glencoe*.*

The Benley Seam has only been worked to a small extent, notwithstanding the proximity of the collieries to the Mount Crosby railway.

The seam can only be traced two or three chains to the westward of *Glencoe Tunnel.* To the northeast it is easily followed to the Boxwood Fault Zone but beyond the fault the identity of the seams underlying the Eclipse Seam is doubtful. A seam which crops out in the left bank of Sandy Creek in portion 137 may reasonably be correlated with the Benley. The seam prospected in Morris' Tunnel in portion 177, and marked "Thin Seam" on Cameron's 1923 map, may, with less certainty, be correlated with the Benley. No sign of the Benley Seam has been found east of this point.

It is estimated that the Benley Seam is on the average some 300 ft. below the Eclipse. The beds lying between the two seams are chiefly shales, which are carbonaceous in places with thin coal bands. Lenticular sandstone beds cause considerable fluctuations in the distance between the seams.

* Abandoned.

Shale and weathered coal beds overlying Waterworks Seam on right bank of Brisbane River, Old Ipswich Waterworks. [*Photo.—A. M. McKenzie.*

In the *Bindley Colliery,* which is still accessible, the coal was found to be in two sections separated by three feet of shale and coal bands. The bottom section was 3 ft. 2 in. thick (with one stone band) and the top section about 4 ft. (with three stone bands). Cameron (1899) reports that there is a third workable section 3 ft. thick 10 ft. above the top section. The same authority reports that the seam in Morris' Tunnel in portion 177 is 2 ft. 3 in. thick with an unspecified number of stone bands.

The partially exposed section of the Benley Seam in a trial tunnel in portion 127, Chuwar, shows the coal to be of inferior quality. Five feet of coal and stone bands are separated from a lower section with a minimum thickness of 3 ft. 3 in. by 4 ft. 6 in. of shale. The coal in the bottom section is streaky and not of workable quality.

The quality of the coal in the Benley Seam is inferior to that in the Eclipse, Tivoli, and Waterstown Seams; but nevertheless it is equal to much of the coal now reaching the market and it is considered that prospecting and development of the seam might reveal important reserves of coal.

Morris' Seam.

Collieries:—Nil.

Among the numerous coal beds occurring between the Benley Seam and the Waterworks Seam there is one seam, hitherto unnamed, which has been prospected to some extent—without success so far. It lies approximately 250 ft. below the Benley Seam and about the same distance above the base of the Waterworks Seam. In portion 176, where Morris drove a tunnel more than 175 yards on the seam, the coal was dull and stony with occasional thin bright bands. The seam is visible in the right bank of Sandy Creek in portion 183, Chuwar. Here it is ten feet thick but appears to be excessively banded.

What is believed to be the same seam is exposed in a gully near Kholo Road in portion 99, Chuwar. The section here is 40 ft. thick and some of the bands of coal are of good quality; but observations were hampered by an almost impenetrable growth of lantana. A prospecting tunnel on a portion of the seam in portion 98 (R. 1002) showed alternating bands of shale and good quality coal.

This seam shows no promise in the eastern exposures, but in the area about Kholo and Waterworks Roads it carries some fine bands of coal, and further prospecting is required to ascertain if any workable section exists.

Waterworks Seam.

Collieries:—Nil.

The Waterworks Seam consists of a thick succession of coal and shale bands and is characterised by an abundance of fossil wood. It is well exposed in the right bank of the Brisbane River at the site of the old weir and pumping station in R.1328, where it has a thickness of about 30 ft. The seam here carries some fine bands of coal but only one section shows any promise of being workable. This section is 2 ft. 8 in. thick and encloses two stone bands.

Isolated exposures of the Waterworks Seam are to be seen in a gully which debouches into the Brisbane River just above the Kholo Bridge. The coal bands are mostly of very good quality but stone bands are numerous and rather thick. One section of 3 ft. 2 in. contained three stone bands aggregating five inches. The coal appeared to be of good quality.

The full section of the seam is exposed in Sandy Creek between portion 189 and portion 181. The creek meanders several times across the seam, which shows up in the bed and sometimes in the high banks. The seam is some 70 ft. thick here but the coal is of rather variable quality and stone bands are excessive throughout. A prospecting tunnel marked "Thorne's Tunnel" on Cameron's 1923 map is driven through some of the lower bands of the seam in portion 181 near the Mount Crosby Road. Cameron (1899) states that the tunnel exposed eight feet of coal and stone bands, the thickest coal band being eight inches.

The Waterworks Seam has been traced, either by its crop or by the underlying sandstone (the "White Conglomerate") as far east as portion 59, Chuwar, but there are no really satisfactory exposures of the coal in this direction. A shale band near the base of the seam in about the centre of portion 179 yielded a wealth of well-preserved fossil plants.

There seems little hope of any large-scale exploitation of the Waterworks Seam, though it is possible that thin sections of it will be found to be workable in the country west of the Boxwood Fault.

Some confusion in mapping has arisen through mistaking the coaly strata in the Tuff Beds for the Waterworks Seam but the association of the former with flaggy shales readily distinguishes it from the Waterworks Seam with the "White Conglomerate" at its base.

CHAPTER 5.

OTHER ECONOMIC PRODUCTS OF THE IPSWICH SERIES.

Compared with coal the other economic products of the Ipswich Series are of very minor importance. They include shale, used in the manufacture of bricks and pottery; sandstone, formerly quarried as a building stone; and conglomerate, which is used for road metal. Ironstone, which outcrops relatively abundantly in places in the form of nodules, has not been used for any purpose. Several oil shales or canneloid coals occurring in association with coal seams were tested, but the oil yields were all too low to warrant any further attention being given to them.

Shale.—Shales in the Dinmore district have been employed in a small way for ceramic purposes. As long ago as 1897 the ceramic industry was firmly established in the Ebbw Vale Pottery at Dinmore. They were employing certain shale beds for special purposes and in some cases they drove tunnels to reach them. There are now two active potteries at Dinmore where Ipswich shales are being employed—the Dinmore and Rylance Brickworks—while a third, the Shannon Brickworks, are not at present active. Shale is being quarried from the upper part of the Cooneana Stage and from the shales about the Bluff Seam.

There is a small pottery at Redbank, now apparently abandoned, where deeply weathered Ipswich shales locally quarried have been employed. Another small pottery at Bundamba, also abandoned, used shales from about Braeside No. 2 Seam.

At North Ipswich the Waterstown Brickworks were turning out a high-quality brick in the eighteen nineties, made from shale overlying the Garden Seam. These brickworks have been long abandoned.

Sandstone.—It must be many years since sandstone was quarried for building purposes in the Ipswich district. Old quarries have been located at Mustering Gully, North Ipswich; Dinmore Rocks (both banks of the river); Redbank (several localities); Redbank Plains Road; and Moggill (two localities).

The Mustering Gully quarries are strung out along the south bank of this small watercourse. None of them is of any great size, but the total quantity of stone recovered must have been quite large. The sandstone occurs as a big lens in the shales underlying the Benley Seam. The main drawback to this stone is the presence of pebbles of varying sizes, which would spoil its appearance if used as a facing stone.

In the vicinity of Dinmore Rocks on the Bremer River north of Dinmore there are three old quarries in a thick bed of sandstone, one on the north bank (in portion 9, Chuwar) and two on the Dinmore side (in portion 34, Goodna). These quarries are capable of yielding large blocks of sandstone, but the grain of the rock is rather coarse and not suitable for most modern building requirements. The horizon of this sandstone is believed to be somewhere about the top of the Tivoli Stage.

There are several small quarries in sandstone west and south-west of Redbank. One of the sandstone beds, which runs in a north-south direction through portion 171, Goodna, is moderately fine-grained, free from pebbles, and apparently of fairly uniform colour and capable of yielding reasonably large blocks. An old quarry south of the railway in R.353, and a prominent landmark to train travellers, is in brown, somewhat coarse sandstone showing rather prominent current bedding. Though available in large blocks and apparently of good weathering qualities, the stone would not commend itself for facing purposes on account of its coarse and rather uneven grain. This is mapped by Cameron as Bundamba Sandstone, but I believe it lies within the Ipswich Series.

There are one or two small quarries in the Cooneana Sandstone in portion 283, near the Redbank Plains Road. The stone is coarse and pebbly and would not be acceptable as a building stone.

In the parish of Moggill sandstone has been quarried at two localities. There are small quarries in portions 110 and 111, the property of Mr. E. F. Bedwell. In the former, 20 ft. of whitish to grey, fine-grained sandstone are resting on a floor of conglomeratic sandstone. Individual beds range from four to six feet in thickness and jointing is infrequent. The excellent weathering qualities of the stone are demonstrated by a number of roughly dressed stones that must have been lying about the quarry for fifty years or more and which show no sign of deterioration. The beds dip to the east at ten degrees into rising ground, so that large quantities of the stone seem assured, though overburden may become troublesome. The quarry in the adjacent portion shows only eight feet of sandstone of similar quality to that in portion 110. Though they are on different horizons both quarries have floors of conglomeratic sandstone. These two quarries are probably those mentioned by W. H. Rands (1890) as lying in portions 9 and 12. For any purpose where a light-coloured sandstone is required these quarries are believed to be capable of supplying an abundance of high-grade stones in reasonably large blocks.

Rands (*loc. cit.*) reports that a quarry had been opened up in portion 135, Moggill, on a white freestone a quantity of which had been used in Brisbane buildings.

There is an old quarry in R.822 between Ouse and Waghorn Streets, Ipswich, where coarse pebbly sandstone has been taken out; but whether for road metal or for building purposes is not known.

Road Metal.—The waste from the Kholo Conlomerate has been used for road building. It is sually scooped up to a depth of two feet or so. 'here are no large quarries in the Conglomerate. 'ebbly sandstone overlying the Benley Seam is uarried for road-making in the south-eastern corner f R.1328, Chuwar, near Waterworks Road in North pswich. Generally speaking, the rocks of the coal ieasures are not favoured for road-building urposes.

Ironstone.—Impure ironstone in the form of arthy hydrated iron oxide is of very common ccurrence in association with shales throughout the eld. In places the material is strewn over the urface in great profusion, giving the impression of irge deposits. Cuttings reveal that much of the ronstone occurs in lenticular and nodular form hrough the shale and not as continuous beds. ronstone in this form is not known to have been een in underground workings but "clay ironstone," r argillaceous iron carbonate, is of common occurence, suggesting strongly that the greater part of he limonitic ore found at the surface has resulted rom the weathering of clay ironstone. Certain ronstone bands lying between the Eclipse and Benley Seams at North Ipswich do not possess the sual nodular habit but are dense and massive and ppear to be continuous at least for a chain or two.)ne such outcrop yielded a large number of small pecimens of coarsely crystalline barytes. It is ggested that these ironstone beds may have been riginally deposited in the form of iron oxide. Ir. L. C. Ball (1904) has reported a bed of clay ironstone forming the floor of the Benley Seam. He also reported that a bed of clay-ironstone in portions 178, 179, Chuwar, can be traced for a distance of a quarter of a mile.

Oil Shale.—Five samples were submitted for proximate analysis and oil yield by destructive distillation. The best of them came from an old tunnel in portion 180, Goodna, where it occurs as a bed 18 inches thick overlying the Little West Moreton Seam. This material is black and tough and has a wooden ring under the hammer. The crude oil yield by destructive distillation was 14 gallons per ton. Samples of similar material from portion 131, Bundamba, and in portion 182, Chuwar, yielded by destructive distillation respectively six gallons and two gallons of crude oil per ton. These are considered to be canneloid coals with an admixture of bituminous coal which reveals itself in the form of bright streaks on a generally dull to greasy surface. The material differs from "bluey" in its toughness and in having a wooden ring under the hammer.

The "oil shale" in *Amberley No. 3 Colliery* occurs as bands in ordinary shale overlying the bottom (?Rob Roy) Seam. It is a black, rather stony substance with a dull lustre and a bright streak. The powder is dark chocolate to black. The yield of crude oil by destructive distillation was eight gallons per ton. The "oil shale" from Ipswich I. Bore was similar to the above, but the oil yield was only four gallons per ton. The prospects of locating commercial oil shale on the Ipswich field are considered remote.

CHAPTER 6.

COAL ANALYSES, TYPE AND RANK.

Sampling.—During the course of the present survey face samples were taken from all working collieries and, where conditions permitted, samples were obtained from abandoned pits. In the case of the larger collieries each working seam was sampled at four widely separated points, while from the smaller mines one to three samples were taken, depending on the output. The method of sampling was to cut a channel from roof to floor four to six inches wide and two to three inches deep. The coal was broken up on the spot to about minus half-inch size and reduced by quartering to about two pounds. Stone bands one inch or more in thickness were discarded. The sample was placed in a two-pound can which was then sealed. In all, 165 coal samples and 5 canneloid coal or "oil shale" samples were taken. All analytical work was done by the Government Analyst of Queensland. In every case the proximate analysis was determined but it was possible to arrange for only a few sulphur and calorific value determinations. Five ultimate analyses were made and in these cases specific gravity determinations, coking and ash tests were carried out.

Rank of the Coal.—The ash of a coal as indicated by a proximate analysis is not an accurate measure of the mineral matter contained in the coal. The latter may be calculated by the Parr formula (U.S.A. Bureau of Mines, Technical Paper 615, 1940, p. 33) as follows:—

$$\text{Mineral Matter (per cent.)} = 1{\cdot}08A + 0{\cdot}55S.$$

The volatile matter on a dry, mineral-matter-free coal basis may then be calculated according to the following formula:—

$$\text{Volatile Matter, Dry Mineral-Matter-Free Coal basis (per cent.)} = \frac{100\ (VM - 0{\cdot}08A - 0{\cdot}4S)}{100 - Mm.}$$

where Mm = mineral matter, per cent.
A = ash, per cent.
S = total sulphur, per cent.
VM = volatile matter, per cent.,
all expressed on a dry coal basis.

The fixed carbon percentage on a dry, mineral-matter-free coal basis is obtained by subtracting the volatile matter on the same basis from 100.

The rank of a coal, according to the generally adopted classification of the American Society for Testing Materials, is based on the fixed carbon content on a dry, mineral-matter-free coal basis. By this classification the Ipswich coals, with fixed carbon (dry, mineral-matter-free basis) ranging from 66·7–79·8 per cent., belong generally to the medium volatile, bituminous group, the limits of which are 69 to 78 per cent. fixed carbon (dry, mineral-matter-free coal). The average fixed carbon value of the coals in the Blackstone Stage lies just within the lower limit for medium volatile coal and a number of individual coals belong to the high volatile group. On the other hand the coals of the Tivoli Stage, with an average fixed carbon value of 72·7 per cent. and a range of 70·3 to 74·3 (omitting the Benley Seam), all lie well within the medium volatile group. The generally higher rank of the Tivoli coals is reflected in their superior coking qualities, in a generally lower moisture content and in certain physical differences.

TABLE 4—TABLE SHOWING RANGES AND AVERAGES OF FIXED CARBON (DRY MINERAL-MATTER-FREE COAL BASIS) OF CERTAIN IPSWICH COALS.

No. in Table of Proximate Analyses.	Seam.	Fixed Carbon (Dry Mineral-Matter-Free Basis).		Average (excluding No. 38).
2	? New Found Out ..	67·3 H	Blackstone Stage.	69·2
15	Aberdare Bottoms ..	67·0 H		
24	Bluff (Top Section) ..	69·1 M		
35	Bluff (Bottom Section) ..	71·1 M		
38	Unnamed Seam between Bluff and Four Foot (Bonnie Dundee Colliery)	74·2 M		
41	Unnamed Seam between Bluff and Four Foot (United No. 5 Colliery)..	69·6 M		
54	Four Foot (Blackheath Colliery)	69·9 M		
63	Four Foot (New Whitwood No. 1 Tunnel)	70·9 M		
64	Four Foot (Aberdare No. 6 Colliery)	66·7 H		
86	Bergin's	68·1 H		
91	Striped Bacon	71·4 M		
97	Rob Roy	69·6 M		
116	Unnamed Seam (Upper Cooneana Stage) ..	71·7 M	Cooneana Stage.	69·7
120	Riverside No. 1	67·6 H		
124	Riverside No. 2	69·2 M		
132	Unnamed Seam about 90 ft. above Garden Seam ..	70·1 M		
134	Garden Seam	73·2 M	Tivoli Stage.	72·7
138	? Fiery Tops (Haighmoor Top Seam)	71·3 M		
140	? Fiery Bottoms (Haighmoor Bottom Seam) ..	72·3 M		
145	Waterstown	73·2 M		
147	Tivoli	74·1 M		
150	Eclipse (New Ebbw Vale No. 3 Colliery)	74·3 M		
159	Eclipse (Rylance Abermain Colliery)	70·7 M		
163	Benley Tops	79·8 L		
164	Benley Bottoms	77·4 M		

H = High Volatile Bituminous Group.
M = Medium Volatile Bituminous Group.
L = Low Volatile Bituminous Group.

Types of Coal.—Mr. N. J. de Jersey, M. Sc., (1944) has studied the microstructure of a number of Ipswich coals, as a result of which he has been able to show that the Tivoli coals, besides being of higher rank than those of Blackstone, are also quite distinct in type. Both groups are predominantly bright coals, splint coal occurring as "thin layers aggregating a small proportion of the total thickness of the seam." (N. J. de Jersey, personal communication.) On the other hand the clarain differs markedly in the two groups. de Jersey (1944) writes—"In the latter [Blackstone Stage coal] spores and cuticles are a persistent feature, and the anthraxylon bands

usually show indications of well-preserved cell-structure, while in the North Ipswich coals spores and cuticles are so rare as to escape detection and the anthraxylon is practically structureless. These features suggest that different environmental conditions prevailed during the formation of each group of seams."

Spores and resins in coal tend to increase the volatile matter, and de Jersey (1946) acknowledges that the absence of spores in the Tivoli coals would give them a slightly higher fixed carbon value than the Blackstone coals. He considers, however, that the proportion of spores and cuticles in the latter would account for less than one-fourth of the chemical differences, which he concludes are mainly attributable to rank difference due to varying degrees of metamorphism. He further concludes that metamorphism of the order observed could have been brought about as a result of the greater thickness of overburden. de Jersey's conclusion does not explain the absence of any general increase in fixed carbon values throughout the Blackstone Stage nor the very considerable variations in fixed carbon values within that stage (66·7 to 74·2 per cent.), and even in a single seam (66·7 to 70·9 per cent. in the Four Foot Seam). If the variations mentioned are due to variation in the proportion of splint coal the fact is not obvious from a macroscopic examination of the coal.

de Jersey (personal communication) has found the two groups of coals to be distinctive in the distribution of mineral matter. He writes—"Mineral matter occurs in the North Ipswich coals almost entirely as particles disseminated through the attritus, sometimes sufficiently abundant to constitute a shale streak or lenticle. In the Bundamba coals mineral matter is much more variable in its occurrence. It occurs as particles of varying grain size disseminated through the bright coal, and more abundantly, in the splint layers, as particles of pyrite in the anthraxylon bands, as colloidal material filling shrinkage cracks in the anthraxylon, and as shale streaks and lenticles associated with the splint coal." From this description the impossibility of freeing any but a very small proportion of the mineral matter by ordinary washing methods is apparent.

Graphical Estimation of Calorific Value.—After a previous sampling campaign carried out in 1941 Mr. L. C. Ball (1945) presented a graphical study of the Ipswich and Walloon coals in which ash percentages were plotted against moisture, volatile matter, fixed carbon, and calorific value. It was found that calorific value varies universally as the ash content, the variation being approximately 100 calories per ash unit. It was seen also that abnormally high or low moisture content was reflected in the calorific value. The graph showed that the calorific value was a constant function of the four elements in the proximate analysis, so that, provided the latter is known, a glance at the graph will show the approximate calorific value of a given sample of coal.

TABLE 5—TABLE OF ULTIMATE ANALYSES.

No. in Table of Proximate Analyses.	Moisture at 105°C.	Carbon.	Hydrogen.	Nitrogen.	Sulphur.	Oxygen (by difference.)	Ash.	Sp. Gr.	Coke.	Ash.	
										Nature.	Fusion Initial Deformation.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.				
15	1·6	72·11	4·63	1·05	0·21	11·70	8·7	1·375	Poor quality, friable	Granular, brick red	
24	2·3	63·29	4·20	0·90	0·29	9·12	19·9	1·453	Poor quality, friable	Granular, pink	Greater than 1,500°C
63	3·1	70·41	4·30	1·09	0·31	9·69	11·1	1·396	Poor quality, friable	Granular, pink	Greater than 1,500°C
97	2·0	63·47	4·08	1·04	0·43	8·88	20·1	1·496	Fair quality ..	Granular, cream	Greater than 1,500°C
150	1·4	69·55	4·14	0·73	0·33	9·35	14·5	1·431	Good quality, dense, hard	Granular, pink	Greater than 1,500°C

TABLE 6—TABLE OF PROXIMATE ANALYSES.

No.	Seam.	Moisture.	Vol. Matter.	Fixed Carbon.	Sulphur.	Ash.	Calorific Value.		Fixed Carbon. Dry Mineral-Matter-free Basis.	Fuel Ratio.		Locality.	Remarks.
							B.T.U. Per lb.	Calories. Per gram.		Dry Ash-free Basis.	Dry Mineral-Matter-free Basis.		
1	Little West Moreton	% 4·7	% 26·8	% 53·6	% 0·23	% 14·9	..	..	..	2·0	..	Old Tunnel, West Moreton Colliery	Slightly weathered coal
2	? "New Found Out"	1·7	30·1	58·6	..	9·6	12,890	7,161	67·3	Av. of two Analyses 2·02	2·06	Stone Drive Section, Aberdare Extd. No. 1 Colliery	
3	? "New Found Out"	1·7	28·9	60·7	..	8·7	..	..	..			Stone Drive Section, Aberdare Extd. No. 1 Colliery	
4	Aberdare Tops ..	2·0	28·2	54·9	..	14·9	..	..	..	Av. of four Analyses 2·06		Blackheath No. 2 Colliery	
5	Aberdare Tops ..	1·9	24·8	51·7	..	21·6	..	..	..			Blackheath No. 2 Colliery	
6	Aberdare Tops ..	2·1	28·2	57·7	..	12·0	12,960	7,200				Blackheath No. 2 Colliery	
7	Aberdare Tops ..	3·0	27·2	58·8	..	11·0	..	..	..			Blackheath No. 1 Colliery	Taken from old face—slightly deteriorated
8	Aberdare Tops ..	2·4	29·2	52·3	..	16·1	..	..	..	Av. of two Analyses 1·79		Southern Cross No. 4 Colliery	
9	Aberdare Tops ..	2·4	29·0	51·5	..	17·1	..	..	..			Southern Cross No. 4 Colliery	
10	Aberdare Tops ..	1·8	27·7	55·9	..	14·6	..	..	..	2·02	..	Hart's Aberdare Colliery	
11	Aberdare Bottoms	2·1	29·8	58·6	..	9·5	..	..	..	Av. of four Analyses 1·85		Box Flat Extd. No. 4 Colliery	
12	Aberdare Bottoms	2·1	29·3	54·7	..	13·9	..	..	..			Box Flat Extd. No. 4 Colliery	
13	Aberdare Bottoms	2·0	31·0	55·9	..	11·1	..	..	..			Box Flat Extd. No. 4 Colliery	
14	Aberdare Bottoms	2·0	31·0	54·4	..	12·6	..	..	..			Box Flat Extd. No. 4 Colliery	
15	Aberdare Bottoms	1·6	30·6	59·1	0·21	8·7	13,040	7,244	67·0	Av. of two Analyses 2·02	2·01	Aberdare Extd. No. 1 Colliery	Sp. Gr. 1·375. Ash granular, brick red. Coke poor quality, friable.
16	Aberdare Bottoms	3·2	29·7	62·9	0·20	4·2	12,740	7,076	..			Aberdare Extd. No. 1 Colliery	Taken from old bord. Coal slightly deteriorated
17	Aberdare Bottoms	2·5	27·7	59·1	..	10·7	..	..	..	2·14	..	Hart's Aberdare Colliery	
18	Aberdare Bottoms	2·7	27·4	58·0	..	11·9	..	..	..	Av. of five Analyses 2·07		Box Flat Extd. No. 2 Colliery	
19	Aberdare Bottoms	2·6	28·6	57·3	..	11·5	..	..	..			Box Flat Extd. No. 2 Colliery	
20	Aberdare Bottoms	2·7	27·1	58·1	..	12·1	..	..	..			Box Flat Extd. No. 2 Colliery	
21	Aberdare Bottoms	2·4	27·3	54·7	..	15·6	..	..	..			Box Flat Extd. No. 2 Colliery	
22	Aberdare Bottoms	2·4	25·6	50·3	..	21·7	..	..	..			Box Flat Extd. No. 2 Colliery	Bottom Section only

23	Aberdare Bottoms	2·6	24·2	51·2	..	22·0	..	..	..	..	..	Blackheath No. 2 Colliery	Bottom Section only
*24	Bluff (Top Section)	2·3	25·9	51·9	0·29	19·9	10,930	6,070	69·1	Av. of three Analyses 2·07	2·24	Box Flat Extd. No. 5 Colliery	Sp. Gr. 1·453. Coke poor quality, friable. Ash granular pink. Softening point of ash > 1,500°C
25	Bluff (Top Section)	2·7	25·3	52·9	0·32	19·1	11,300	6,280	..			Box Flat Extd. No. 5 Colliery	
26	Bluff (Top Section)	2·6	25·2	52·9	..	19·3	..	..	..			Box Flat Extd. No. 5 Colliery	
27	Bluff (Top Section)	2·3	26·4	53·1	..	18·2	..	..	..	2·01	..	Thistle No. 4 Colliery	
28	Bluff (Top Section)	1·7	26·9	51·3	..	20·1	..	..	..	Av. of four Analyses 1·92		Southern Cross No. 6 Colliery	
29	Bluff (Top Section)	1·7	25·9	49·7	..	22·7	..	..	..			Southern Cross No. 6 Colliery	
30	Bluff (Top Section)	1·7	26·7	51·4	..	20·2	..	..	..			Southern Cross No. 6 Colliery	
31	Bluff (Top Section)	1·7	26·4	51·2	..	20·7	..	..	..			Southern Cross No. 6 Colliery	
32	Bluff (Bottom Section)	2·0	27·4	52·9	..	17·7	..	..	..	1·93	..	Tunnel near Southern Cross No. 6 Colliery	
33	Bluff (Bottom Section)	2·3	23·5	55·0	..	19·2	..	..	..	2·35	..	United No. 5 Extd. Colliery	
34	Bluff (Bottom Section)	3·6	26·9	57·4	..	12·1	..	..	..	2·14	..	Palmer's Aberdare Colliery	
35	Bluff (Bottom Section)	2·3	25·0	55·7	0·30	17·0	11,680	6,490	71·1	2·23	2·46	Box Flat Extd. No. 5 Colliery	
36	Bluff (Bottom Section)	2·7	25·1	50·8	..	21·4	..	..	..	2·02	..	Noblevale No. 5 Colliery	
37	? Bluff	3·1	26·1	53·7	..	17·1	..	..	..	..	..	Trial Tunnel near Noblevale No. 6 Colliery	
38	Unnamed Seam (between Bluff and Four Foot)	3·2	21·7	53·9	0·36	21·2	11,171	6,206	74·2	2·50	2·87	Old Bonnie Dundee Colliery	Old coal face. Coal slightly deteriorated
39	Unnamed Seam (between Bluff and Four Foot)	2·3	23·5	44·8	..	29·4	..	..	..	1·91	..	Trial Shaft, por. 5, Bundamba	Grab sample from shaft dump
40	Unnamed Seam (between Bluff and Four Foot)	2·2	25·4	52·0	..	20·4	..	..	..	Av. of two Analyses 2·06		United No. 5 Colliery	
41	Unnamed Seam (between Bluff and Four Foot)	2·4	26·2	54·3	0·33	17·1	11,200	6,222	69·6		2·29	United No. 5 Colliery	
42	Four Foot — Top Coal	1·8	28·2	51·8	..	18·2	..	..	..	1·83	..	Aberdare No. 7 Colliery	
43	Four Foot — Top Coal	2·5	24·2	47·6	..	26·7	..	..	..	Av. of two Anaylses 1·95		Bonnie Dundee No. 2 Colliery	
44	Four Foot — Top Coal	2·4	25·4	49·0	..	23·2	..	..	..			Bonnie Dundee No. 2 Colliery	

* See Table of Ultimate Analyses.

TABLE 6—TABLE OF PROXIMATE ANALYSES.—*continued.*

No.	Seam.	Moisture.	Vol. Matter.	Fixed Carbon.	Sulphur.	Ash.	Calorific Value.		Fixed Carbon. Dry Mineral-Matter-free Basis.	Fuel Ratio.		Locality.	Remarks.
							B.T.U. Per lb.	Calories. Per gram.		Dry Ash-free Basis.	Dry Mineral-Matter-free Basis.		
45	Four Foot — Top Coal	2·3	25·1	48·4	..	24·2	..	..	..	Av. of three Analyses 1·91		Belmont Colliery No. 3	
46	Four Foot — Top Coal	2·2	24·8	47·8	..	25·2	10,916	6,064	..			Belmont Colliery No. 3	
47	Four Foot — Top Coal	2·1	24·6	45·3	..	28·0	..	..	..			Belmont Colliery No. 3	
48	Four Foot — Roof Bands	2·6	24·9	51·2	..	21·3	..	..	..	Av. of two Analyses 1·98		Noblevale Colliery. Tunnel No. 1 No. 3	
49	Four Foot — Roof Bands	2·2	25·9	49·8	..	22·1	..	..	..			Noblevale Colliery Tunnel No. 1 No. 3	
50	Four Foot — "Brushing Band"	2·2	24·8	46·7	..	26·3	..	..	..	..	..	Bonnie Dundee Colliery No. 2	
51	Four Foot — Main Seam including "Brushing Band"	2·1	25·8	52·5	..	19·6	..	..	..	Av. of four Analyses 2·07		Blackheath Colliery No. 1	
52	Four Foot — Main Seam including "Brushing Band"	2·0	25·6	49·0	..	23·4	..	..	..			Blackheath Colliery No. 1	
53	Four Foot — Main Seam including "Brushing Band"	1·8	27·1	56·5	..	14·6	..	..	..			Blackheath Colliery No. 1	
54	Four Foot — Main Seam including "Brushing Band"	2·0	26·1	55·3	0·34	16·6	12,324	6,848	69·9		2·32	Blackheath Colliery No. 1	
55	Four Foot — Main Seam including "Brushing Band"	2·5	25·9	53·7	..	17·9	..	..	..	Av. of two Analyses 2·03		Bonnie Dundee Colliery No. 2	
56	Four Foot — Main Seam including "Brushing Band"	2·5	26·1	52·0	..	19·4	..	..	..			Bonnie Dundee Colliery No. 2	
57	Four Foot — Main Seam including "Brushing Band"	2·3	25·1	56·0	0·40	16·6	..	..	..	2·24	..	Belmont Colliery No. 3	
58	Four Foot — Main Seam	2·9	27·1	55·1	..	14·9	..	..	..	Av. of two Analyses 1·98		Bonnie Dundee Colliery No. 2	
59	Four Foot — Main Seam	2·3	24·4	46·8	..	26·5	..	..	..			Bonnie Dundee Colliery (cross dip) No. 2	
60	Four Foot — Main Seam	2·5	28·8	60·0	..	8·7	..	..	..	2·09	..	Aberdare Colliery No. 7	
61	Four Foot — Main Seam	2·7	27·1	58·7	..	11·5	..	..	..	Av. of three Analyses 2·23		New Whitwood Tunnel No. 1	
62	Four Foot — Main Seam	3·4	25·9	58·8	..	11·9	..	..	..			New Whitwood Tunnel No. 1	
*63	Four Foot — Main Seam	3·1	26·6	59·2	0·31	11·1	12,950	7,198	70·9		2·43	New Whitwood Tunnel No. 1	Sp. Gr. 1·396. Coke *poor quality, friable.* Ash granular, pink. Softening point of

64	Four Foot — Main Seam	2·1	27·1	52·0	0·34	18·8	11,550	6,420	60·7	Av. of four Analyses 1·88	2·01	Aberdare Colliery No. 6
65	Four Foot — Main Seam	1·9	27·1	50·7	..	20·3	..	..	..			Aberdare Colliery No. 6
66	Four Foot — Main Seam	1·8	27·8	52·8	..	17·6	..	..	..			Aberdare Colliery No. 6
67	Four Foot — Main Seam	1·9	27·9	50·8	..	19·4	..	..				Aberdare Colliery No. 6
68	Bergin's	2·7	25·2	49·3	..	22·8	..	..	..	Av. of four Analyses 1·90		Bonnie Dundee No. 2 Colliery
69	Bergin's	2·8	24·0	46·0	..	27·2	..	..	..			Bonnie Dundee No. 2 Colliery
70	Bergin's	2·4	26·0	48·2	..	23·4	..	..	..			Bonnie Dundee No. 2 Colliery
71	Bergin's	3·1	27·1	52·2	..	17·6	..	..	..			Bonnie Dundee No. 2 Colliery
72	Bergin's	1·4	26·3	50·2	..	22·1	..	..	..	Av. of four Analyses 1·88		New Aberdare E. No. 3 Colliery
73	Bergin's	1·2	27·0	50·7	..	21·1	..	..	..			New Aberdare E. No. 3 Colliery
74	Bergin's	1·3	25·7	47·6	..	25·4						New Aberdare E. No. 3 Colliery
75	Bergin's	2·0	26·2	48·4	..	23·4	..	..	..			New Aberdare E. No. 3 Colliery
76	Bergin's	1·8	27·5	50·2	..	20·5	11,580	6,435	..	..	..	Aberdare Colliery No. 8
77	Bergin's — Top Section	2·3	25·4	49·4	..	22·9	..	..	..	Av. of three Analyses 1·98		Whitwood Colliery No. 3
78	Bergin's — Top Section	2·3	25·3	48·4	..	24·0	..	..	..			Whitwood Colliery No. 3
79	Bergin's — Top Section	2·8	25·3	52·8	..	19·1	..	..	..			Whitwood Colliery No. 3
80	Bergin's — Top Section	2·7	23·9	47·0	..	26·4	..	..		Av. of two Analyses 2·13		Rhondda Colliery
81	Bergin's — Top Section	2·9	25·1	57·3	..	14·7	..	..				Rhondda Colliery
82	Bergin's — Top Section	2·3	25·0	53·3	..	19·4	6	..	..	2·14	..	Amberley Colliery No. 3
83	Bergin's — Bottom Section	3·0	25·9	52·6	..	18·5	..	..	..	2·03	..	Rylance Colliery No. 3
84	Bergin's — Bottom Section	2·2	26·5	55·0	..	16·3	..	..	..	Av. of two Analyses 1·99		Rhondda Colliery ..
85	Bergin's — Bottom Section	2·0	28·3	54·3	..	15·4	..	..	..			Rhondda Colliery ..
86	Bergin's — Bottom Section	2·4	25·6	47·7	0·48	24·3	10,810	6,006	68·1	1·76	2·13	Whitwood Colliery No. 3
87	Striped Bacon ..	2·4	24·6	52·6	..	20·4	..	..	..	2·14	..	Rylance Colliery No. 3
88	Striped Bacon ..	2·3	25·1	56·0	..	16·6	..	..	..	Av. of four Analyses 2·2		Whitwood Colliery No. 3
89	Striped Bacon ..	2·4	24·5	52·6	..	20·5	..	..	..			Whitwood Colliery No. 3
90	Striped Bacon ..	3·0	23·7	52·1	..	21·2	..	..	..			Whitwood Colliery No. 3
91	Striped Bacon ..	2·9	24·5	54·3	0·38	18·3	11,470	6,371	71·4		2·50	Whitwood Colliery No. 3

* See Table of Ultimate Analyses.

TABLE 6—TABLE OF PROXIMATE ANALYSES.—*continued.*

No.	Seam.	Moisture.	Vol. Matter.	Fixed Carbon.	Sulphur.	Ash.	Calorific Value.		Fixed Carbon. Dry Mineral-Matter-free Basis.	Fuel Ratio.		Locality.	Remarks.
							B.T.U. Per lb.	Calories. Per gram.		Dry Ash-free Basis.	Dry Mineral-Matter-free Basis.		
92	Striped Bacon ..	2·3	24·0	53·0	..	20·7	..	..	..	Av. of four Analyses 2·15		Rhondda Colliery ..	
93	Striped Bacon ..	2·0	25·3	53·2	..	19·5	..	..	..			Rhondda Colliery ..	
94	Striped Bacon ..	2·0	25·6	54·1	..	18·3	..	..	..			Rhondda Colliery ..	
95	Striped Bacon ..	2·2	24·8	53·3	..	19·7	..	..	..			Rhondda Colliery ..	
96	Rob Roy	1·9	25·4	52·0	..	20·7	..	..	..	Av. of four Analyses 2·06	..	Rhondda Colliery ..	
*97	Rob Roy	2·0	25·5	52·4	0·43	20·1	11,140	6,187	69·6		2·29	Rhondda Colliery ..	Sp. Gr. 1·496. Coke fair quality. Ash granular, cream. Softening point of ash > 1,500°C
98	Rob Roy	2·1	26·7	54·9	..	16·3	..	..	..			Rhondda Colliery ..	
99	Rob Roy	1·9	24·6	50·1	..	23·4	..	..	..			Rhondda Colliery ..	
100	Rob Roy	1·8	25·8	54·4	..	18·0	..	..	..	Av. of four Analyses 2·14		Rylance No. 3 Colliery	
101	Rob Roy	1·9	25·8	53·2	0·40	19·1	11,670	6,318	..			Rylance No. 3 Colliery	
102	Rob Roy	1·7	25·2	55·1	..	18·0	..	..	..			Rylance No. 3 Colliery	
103	Rob Roy	1·8	24·5	53·5	..	20·5	..	..	..			Rylance No. 3 Colliery	
104	? Rob Roy ..	1·1	26·5	50·9	0·39	21·5	11,349	6,305	..	1·92	..	Amberley No. 3 Colliery	
105	?	1·7	26·6	57·1	0·37	14·6	12,836	7,131	..	2·14	..	Eureka Colliery ..	
106	Braeside No. 2 ..	2·8	25·5	45·7	..	26·0	..	..	..	1·79	..	New Ebbw Vale No. 1 Colliery	
107	Braeside No. 3 ..	3·1	26·7	50·5	..	19·7	11,300	6,276	..	1·89	..	Rylance No. 5 Colliery	
108	? Braeside No. 4 ..	1·9	27·0	59·0	..	12·1	..	..	..	Av. of four Analyses 2·13		United No. 1 Colliery	Coke hard, dense, black
109	? Braeside No. 4 ..	1·9	27·2	58·4	..	12·5	..	..	..			United No. 1 Colliery	Coke hard, dense, black
110	? Braeside No. 4 ..	2·2	27·1	56·9	..	13·8	..	..	..			United No. 1 Colliery	Coke hard, dense, black
111	? Braeside No. 4 ..	1·6	23·7	55·9	..	18·8	12,620	7,011	..			United No. 1 Colliery	Coke hard, dense, black
112	Unnamed	2·2	27·5	55·4	..	14·9	..	..	..	2·01	..	United No. 1 Colliery Top Seam in Prosp. Shaft	Coke hard, dense, black
113	Unnamed	2·1	27·5	54·9	..	15·5	..	..	..	..	..	United No. 1 Colliery Bottom Seam in Prosp. Shaft	Coke hard, dense, black
114	Unnamed	2·2	24·2	47·5	..	26·1	10,672	5,874	..	1·96	..	Prosp. Shaft Bonnie Dundee No. 2 Colliery	Coke loose and friable

115	Unnamed (Roof Band)	2·6	23·8	54·1	..	19·5	..	..	..	..	..	Jones' Trial Shaft, por. 283, Goodna, 10 ch. N.W. of Cooneana House	
116	Unnamed (Main Seam)	2·9	22·6	49·0	0·55	25·5	10,550	5,862	71·7	2·17	2·53	Jones' Trial Shaft, por. 283, Goodna, 10 ch. N.W. of Cooneana House	
117	Unnamed	11·0	26·5	52·1	..	10·4	..	..	..	..	..	Trial Shaft, por. 214, Goodna	Weathered coal
118	?	2·2	26·6	52·2	..	19·0	..	..	..	1·96	..	Noblevale No. 1 Colliery No. 4 Tunnel	
119	Unnamed	2·0	25·0	46·0	..	27·0	..	..	..	1·84	..	Bonnie Dundee No. 4 Tunnel	Slightly weathered coal
120	Riverside No. 1 ..	1·4	28·0	52·8	0·67	17·8	11,980	6,658	67·6	Av. of four Analyses 1·95	2·08	Riverside No. 3 Colliery	
121	Riverside No. 1 ..	1·6	27·6	54·2	..	16·6	..	..				Riverside No. 3 Colliery	
122	Riverside No. 1 ..	1·3	27·1	54·1	..	17·5	..	..				Riverside No. 3 Colliery	
123	Riverside No. 1 ..	1·4	28·1	55·0	..	15·5	..	..				Riverside No. 3 Colliery	
124	Riverside No. 2 Top Section	1·0	25·1	50·8	0·57	23·1	10,910	6,060	69·2	Av. of three Analyses 2·07	2·25	Riverside No. 2 Colliery	
125	Riverside No. 2 Top Section	1·1	24·6	54·3	..	20·0	..	..				Riverside No. 2 Colliery	
126	Riverside No. 2 Top Section	1·4	25·1	49·1	..	24·4	..	..				Riverside No. 2 Colliery	
127	Riverside No. 2 Bottom Section	1·5	24·2	48·7	..	25·6	..	..	..	..	..	Riverside No. 2 Colliery	
128	? Riverside No. 1 Seam	2·6	24·4	52·4	..	20·6	..	..	..	2·15	..	Prior's Colliery, por. 133, Moggill	Selected pieces of coal from dump
129	Unnamed	1·7	27·9	55·9	..	14·5	..	..	..	2·00	..	Prosp. Shaft in por. 33, Goodna	Selected pieces of coal from dump
130	Unnamed	2·3	28·0	62·8	..	6·9	..	..	..	2·25	..	Prosp. Shaft, N. end of por. 33, Goodna	Selected pieces of coal from dump. Coke soft, friable
131	Unnamed	1·6	25·0	57·6	..	15·8	..	..	..	2·30	..	Seam 1 ft. thick at depth of 190 ft. in bore, por. 8, Ipswich	
132	Unnamed	2·2	26·1	55·7	0·44	16·0	..	..	70·1	2·14	2·35	Prosp. Shaft, por. 32, Chuwar	Selected pieces of coal from dump
133	Garden (part of) ..	17·3	27·7	43·7	..	11·3	..	..	..	..	..	"Engine Tunnel," Abermain Colliery	Weathered coal
134	Garden	3·5	24·8	61·4	0·47	10·3	..	..	73·2	..	2·73	Dolly Varden Tunnel, Abermain Colliery	Selected pieces of coal from dump
135	Tantivy — Roof Band	2·0	21·3	53·0	..	23·7	..	..	..	..	..	Edina Tunnel, Abermain Colliery	

* See Table of Ultimate Analyses.

TABLE 6—TABLE OF PROXIMATE ANALYSES.—*continued.*

No.	Seam.	Moisture.	Vol. Matter.	Fixed Carbon.	Sulphur.	Ash.	Calorific Value.		Fixed Carbon. Dry Mineral-Matter-free Basis.	Fuel Ratio.		Locality.	Remarks.
							B.T.U. Per lb.	Calories. Per gram.		Dry Ash-free Basis.	Dry Mineral-Matter-free Basis.		
136	? Tantivy	3·0	24·2	58·2	..	14·6	..	..	..	..	..	Trial Tunnel in por. 36, Chuwar	Selected pieces of coal from dump
137	? Fiery Tops—Top Section	2·2	25·5	59·5	..	12·8	..	..	..	..	..	Bell Tunnel, por. 36, Chuwar	
138	? Fiery Tops—Top Section	2·8	25·5	56·1	0·59	15·6	9,341	5,195	71·3	..	2·48	Haighmoor Colliery	
139	? Fiery Tops—Bottom Section	1·6	24·6	61·3	..	12·5	13,560	7,535	..	..	..	Haighmoor Colliery	
140	? Fiery Bottoms ..	2·2	23·5	54·6	0·58	19·7	12,110	6,728	72·3	2·32	2·61	Haighmoor Colliery	
141	? Fiery Bottoms ..	2·1	22·4	52·5	..	23·0	..	..	..	..	..	Haighmoor Colliery	
142	? Fiery Bottoms ..	1·4	24·7	58·6	..	15·3	..	..	..	..	..	Haighmoor Colliery	
143	? Fiery Bottoms (Floor Band)	1·2	26·1	55·6	..	17·1	..	..	..	..	..	Haighmoor Colliery 15-inch band below worked section	Slightly weathered coal
144	? Fiery Bottoms ..	3·9	21·9	55·9	..	18·3	10,570	5,872	..	2·56	..	Trial Tunnel in por. 62, Chuwar	
145	Waterstown ..	1·3	23·1	61·8	0·76	13·8	12,600	7,000	73·2	2·72	2·73	Rylance Abermain Colliery	
146	?	2·5	24·9	56·2	0·48	16·4	..	..	..	2·26	2·51	Trial Tunnel in por. 11, Chuwar	
147	Tivoli	3·0	23·9	61·1	0·57	12·0	..	..	71·4	2·56	2·96	Rothwell Haigh Colliery	Slightly weathered coal
148	Tivoli	1·0	22·7	54·3	..	22·0	11,761	6,534	..	2·4	..	Rylance Abermain Colliery	
149	Tivoli	1·9	21·7	59·6	..	16·8	12,960	7,200	..	2·76	..	New Eclipse Colliery	
*150	Eclipse	1·4	23·0	61·1	0·33	14·5	12,620	7,009	74·3	..	2·89	New Ebbw Vale No. 3 Colliery	Sp. Gr. 1·431. Coke good quality, dense, hard. Ash granular, pink. Softening point of ash > 1,500°C
151	Eclipse	1·4	23·7	59·4	..	15·5	..	..	..	..	..	New Ebbw Vale No. 3 Colliery	
152	Eclipse	1·5	23·5	56·8	..	18·2	..	..	..	..	..	New Ebbw Vale No. 3 Colliery	
153	Eclipse	1·4	23·7	59·2	..	15·7	..	..	..	2·5	..	New Ebbw Vale No. 3 Colliery	

154	Eclipse	1·5	23·0	57·9	..	17·6	..	..	..	..	..	New Ebbw Vale No. 3 Colliery	
155	Eclipse	1·4	23·1	59·5	..	16·0	..	..	..	..	..	New Ebbw Vale No. 3 Colliery	Slack from hopper
156	Eclipse	2·3	23·0	57·6	0·41	17·1	12,604	7,002	..	2·5	..	Klondyke Colliery ..	
157	Eclipse	1·5	22·4	58·3	..	17·8	..	..	..	..	..	Klondyke Colliery ..	
158	Eclipse	1·5	22·9	52·5	..	23·1	..	..	..	..	..	Klondyke Colliery ..	
159	Eclipse	0·8	25·1	56·6	0·53	17·5	12,558	..	70·7	2·26	2·42	Rylance Abermain Colliery	
160	Eclipse Tops ..	1·4	21·7	51·7	..	25·2	..	..	..	..	..	New Ebbw Vale No. 3 Colliery	
161	Eclipse Tops ..	1·5	21·9	52·1	..	24·5	..	..	..	..	..	Klondyke Colliery ..	
162	Eclipse Tops ..	1·5	22·3	55·6	..	20·6	..	..	..	..	..	Klondyke Colliery ..	
163	Benley — Top Section	1·9	17·3	58·6	0·34	22·2	11,760	6,535	79·8	3·39	3·96	Bindley Colliery ..	
164	Benley — Bottom Section	1·9	18·9	55·8	0·31	23·4	12,136	6,742	77·4	..	3·42	Bindley Colliery ..	
165	Unnamed	1·9	15·7	41·0	..	41·4	..	..	..	2·61	..	Mount Crosby, Old Weir	Outcrop coal

"Oil Shale" and Low Grade Canneloid Coal.

	Canneloid Coal ..	6·2	14·4	19·0	60·4	..	..	..	..	..	..	Por. 182, Chuwar ..	Oil yield 2 gallons per ton
	Canneloid Coal ..	4·1	21·2	28·3	46·4	..	..	..	..	..	..	West Moreton Colliery	Oil yield 14 gallons per ton
	Canneloid Coal ..	8·2	21·3	28·1	42·4	..	..	..	..	..	..	Trial Tunnel por. 131, Bundamba	Oil yield 6 gallons per ton
	"Oil Shale" ..	2·0	11·7	12·6	73·7	..	..	..	..	..	..	Amberley No. 3 Colliery	Oil yield 8 gallons per ton
	"Oil Shale" ..	1·9	12·3	7·8	78·0	..	..	..	..	..	..	Ipswich 1 Borehole por. 5, Bundamba	Oil yield 4 gallons per ton

* See Table of Ultimate Analyses.

Average Ash of Coal in Blackstone Stage	18·7 per cent.
Average Ash of Coal in Tivoli Stage	18·0 per cent.
Average Ash all worked Coal (based on above Analyses)	18·5 per cent.
Range of Ash Content of all worked Coals (Based on above Analyses) ..	4·2 per cent. to 28 per cent.
Average Moisture of unweathered coals	2·1 per cent.
Average Moisture Blackstone Stage Coals	2·2 per cent.
Average Moisture Tivoli Stage Coals	1·7 per cent.

CHAPTER 7.

COAL BENEFICIATION AND UTILISATION.

Beneficiation of the coal is not generally practised. The number of collieries equipped with washeries is only six, out of a total of thirty-one operating pits.

Benefication is achieved (1) by the use of picking belts; (2) by wet washing; (3) by dry cleaning. In some collieries hand-picking of the lump coal is carried out as well as washing of the screened coal. It is usual to eliminate the coal above two inches and less than a quarter of an inch prior to washing by means of revolving screens. One type of washing plant in use is the Rheolaveur, in which the screened coal is carried along sloping launders by a stream of water, passing at intervals over narrow traps in which a strong current of water is being forced upward. The upward current is so adjusted that the clean coal is carried over the trap but the stone falls to the bottom. Also in use is the Elliott type of trough washer in which the coal is washed down a gently sloping trough by a stream of water and the stone particles which settle to the bottom are carried away by mechanical scrapers which move slowly up the trough. Still another type in use is fitted with a shaking plate with a number of perforations through which there is a continuous upward current of water. In passing over the plate the clean coal is forced to the top, the stone sinking to the bottom, to be removed by a trap, as in the Rheolaveur type. In the dry washer the coal is passed over a shaking table, the deck of which is fitted with riffles and is pervious to air. The table itself is in the form of a box into which an air blast is admitted. The air current lifts the lighter coal particles to the top and they move straight down the table, while the heavier shale fragments travel along the riffles and are discharged at the end of the table.

At *Blackheath Colliery* washing is reported to reduce the ash content of the coal from 17 or 18 per cent. to 11 or 12 per cent. In *Bonnie Dundee No.* 2 the rejects, which amount to between 8 and 9 per cent. of the coal put through the plant, contain about 30 per cent. coal, the loss of coal in washing thus being less than 3 per cent. The plant at *Whitwood No.* 3 is claimed to remove 70 per cent. of the stone.

The collieries equipped with washeries are: *Blackheath, Bonnie Dundee No.* 2, *New Aberdare East No.* 3, *Rhondda, Rylance No.* 3 (wet and dry cleaners), *Whitwood No.* 3.

Utilisation.—Mr. W. Thomas, Secretary of the West Moreton District Coal Board, has kindly supplied the following figures relating to the disposal of the coal from the Ipswich field (including Walloon-Rosewood) for the twelve months ended 30th June, 1945.

	Tons.
Railways	150,529
Gas	116,510
Bunker	36,901
Electricity Supply	273,112
Miscellaneous	216,142
Total ..	793,194

The percentages of the total output absorbed by the various undertakings are:

Railways	19·0 per cent.
Gas	14·7 per cent.
Bunker	4·6 per cent.
Electricity Supply	34·4 per cent.
Miscellaneous	27·3 per cent.

If the Walloon-Rosewood coals were excluded the above percentages would have to be modified somewhat, particularly in relation to gas, as a large proportion of the Walloon coal is employed for gas-making. The figure given for Railways includes the coal used at the Railway Workshops, Ipswich, but this is reported to be a trifling amount compared with the coal used by locomotives. "Miscellaneous" includes the coal used in boilers by the various collieries and not actually sold.

Coke-making was formerly a flourishing industry among the Tivoli mines but with the decline of mining in that district coke-making has shrunk to very small proportions. At present only one pit, *Klondyke,* is equipped with coke ovens, the output for 1945 being 2,925 tons valued at £7,160. The coke ovens were all of the Beehive type. So far as is known, no attempt has ever been made to recover the by-products. In general the coals of the Blackstone Stage do not make a satisfactory coke and they would be classed as non-coking. The Tivoli coal is reported to make an excellent forge coal, and it is much sought after for "smithy" purposes.

The average pit-head price of all types of coal during 1945 was £1 1s. 3d. per ton.

CHAPTER 8.
COAL PRODUCTION AND RESERVES.

Production figures for the early years of the field up to 1882 are given by Fryar (1900). Regarding these figures Fryar writes, "During the few years immediately preceding the time now mentioned [1883] there had been a little work done on the Burrum River, about 15 miles north of Maryborough, but the output had been small and intermittent, and, if recorded at all, is incorporated with that of Ipswich—then, with that exception, the only place where coal was produced in the colony."

The Ipswich returns from 1896 until 1909 include the output from the Darling Downs which is believed to have totalled over this period no more than half-a-million tons. The returns also include the output of the Walloon-Rosewood pits from 1881 on. In 1920 the output of the Walloon-Rosewood district was not much over seven per cent. of the total production, but in recent years it has risen to 25 per cent. or more. Allowing a total production of 3½ million tons for Walloon-Rosewood, the total output of the Ipswich field to the end of 1945 is almost 28 million tons. This represents approximately 58 per cent. of the State's total output.

The following tables show, A the output of the Ipswich field from 1860 to 1945, and B the output of the various collieries for six years from 1939 to 1944.

TABLE 7—OUTPUT OF THE IPSWICH FIELD FROM 1860 TO 1945.

Year.	Tons.	—
1860	12,327	Ipswich only
1861	14,212	Ipswich only
1862	24,067	Ipswich only
1863	24,000	Ipswich only
1864	25,000	Ipswich only
1865	33,000	Ipswich only
1866	39,316	Ipswich only
1867	17,988	Ipswich only
1868	19,611	Ipswich only
1869	11,120	Ipswich only
1870	22,639	Ipswich only
1871	17,000	Ipswich only
1872	27,727	Ipswich only
1873	33,613	Ipswich only
1874	43,443	Ipswich only
1875	32,107	Ipswich only
1876	50,627	Ipswich only
1877	60,918	Ipswich only
1878	52,580	Ipswich only
1879	55,012	Ipswich only
1880	58,052	Ipswich only
1881	65,612	Ipswich only
1882	74,436	Ipswich only
1883	98,310	Ipswich and Walloon-Rosewood
1884	114,577	Ipswich and Walloon-Rosewood
1885	180,744	Ipswich and Walloon-Rosewood
1886	189,608	Ipswich and Walloon-Rosewood
1887	193,286	Ipswich and Walloon-Rosewood
1888	254,778	Ipswich and Walloon-Rosewood
1889	217,240	Ipswich and Walloon-Rosewood
1890	276,063	Ipswich and Walloon-Rosewood
1891	222,766	Ipswich and Walloon-Rosewood
1892	215,535	Ipswich and Walloon-Rosewood
1893	202,429	Ipswich and Walloon-Rosewood
1894	207,672	Ipswich and Walloon-Rosewood
1895	239,712	Ipswich and Walloon-Rosewood
1896	280,094	Ipswich, Walloon-Rosewood and Darling Downs
1897	277,172	Ipswich, Walloon-Rosewood and Darling Downs
1898	310,444	Ipswich, Walloon-Rosewood and Darling Downs
1899	373,655	Ipswich, Walloon-Rosewood and Darling Downs
1900	379,504	Ipswich, Walloon-Rosewood and Darling Downs
1901	420,500	Ipswich, Walloon-Rosewood and Darling Downs
1902	390,603	Ipswich, Walloon-Rosewood and Darling Downs
1903	403,462	Ipswich, Walloon-Rosewood and Darling Downs
1904	408,186	Ipswich, Walloon-Rosewood and Darling Downs
1905	422,642	Ipswich, Walloon-Rosewood and Darling Downs
1906	509,989	Ipswich, Walloon-Rosewood and Darling Downs
1907	591,174	Ipswich, Walloon-Rosewood and Darling Downs
1908	591,535	Ipswich, Walloon-Rosewood and Darling Downs
1909	642,864	Ipswich, Walloon-Rosewood and Darling Downs
1910	665,039	Ipswich and Walloon-Rosewood
1911	624,071	Ipswich and Walloon-Rosewood
1912	598,505	Ipswich and Walloon-Rosewood
1913	695,422	Ipswich and Walloon-Rosewood
1914	718,205	Ipswich and Walloon-Rosewood
1915	682,491	Ipswich and Walloon-Rosewood
1916	583,692	Ipswich and Walloon-Rosewood
1917	728,605	Ipswich and Walloon-Rosewood
1918	678,931	Ipswich and Walloon-Rosewood
1919	620,608	Ipswich and Walloon-Rosewood
1920	763,590	Ipswich and Walloon-Rosewood
1921	666,236	Ipswich and Walloon-Rosewood
1922	579,184	Ipswich and Walloon-Rosewood
1923	607,983	Ipswich and Walloon-Rosewood
1924	596,721	Ipswich and Walloon-Rosewood
1925	614,055	Ipswich and Walloon-Rosewood
1926	649,184	Ipswich and Walloon-Rosewood
1927	612,888	Ipswich and Walloon-Rosewood
1928	583,990	Ipswich and Walloon-Rosewood
1929	667,640	Ipswich and Walloon-Rosewood
1930	566,391	Ipswich and Walloon-Rosewood
1931	438,961	Ipswich and Walloon-Rosewood
1932	436,684	Ipswich and Walloon-Rosewood
1933	439,496	Ipswich and Walloon-Rosewood
1934	469,843	Ipswich and Walloon-Rosewood
1935	496,411	Ipswich and Walloon-Rosewood
1936	499,732	Ipswich and Walloon-Rosewood
1937	546,259	Ipswich and Walloon-Rosewood
1938	547,901	Ipswich and Walloon-Rosewood
1939	627,965	Ipswich and Walloon-Rosewood
1940	625,683	Ipswich and Walloon-Rosewood
1941	689,680	Ipswich and Walloon-Rosewood
1942	751,177	Ipswich and Walloon-Rosewood
1943	755,660	Ipswich and Walloon-Rosewood
1944	802,268	Ipswich and Walloon-Rosewood
1945	812,640	Ipswich and Walloon-Rosewood
Total ..	31,872,743	

Reserves.—Apart from pillar coal positive reserves on the Ipswich field are very small. This is due to (*a*) the great variability of the coal, and (*b*) the almost entire absence of diamond drilling ahead of coal faces. A good deal of information has been

TABLE 8—TABLE SHOWING OUTPUT OF THE VARIOUS COLLIERIES ON THE IPSWICH FIELD FOR THE YEARS 1939 TO 1944.

Colliery.	1939.	1940.	1941.	1942.	1943.	1944.
	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.	Tons cwt.
Aberdare No. 5	..	8,889 6	10,509 9	3,227 4	..	..
Aberdare No. 6	..	..	..	9,254 13	25,118 13	27,398 18
Aberdare No. 7	..	..	..	1,818 13	18,289 16	24,432 8
Aberdare Extended No. 1	61,402 2	55,169 3	60,937 4	65,638 3	61,418 6	46,468 13
Aberdare Extended No. 2	7,179 12	..	..	..	..	..
Aberdare West	22,766 0	3,413 2	..	..	..	..
Amberley No. 3	..	..	..	4,308 9	3,089 11	12,467 14
Belmont No. 3	..	..	..	8,601 5	9,612 0	9,754 18
Blackheath	42,306 8	42,648 3	46,156 2	51,030 16	56,553 19	56,142 14
Bonnie Dundee	23,647 0	19,203 0	23,876 0	23,436 0	22,423 0	23,117 0
Box Flat Extended	49,905 1	50,794 3	63,886 4	64,343 18	63,098 5	62,008 17
Hart's Aberdare No. 3	15,150 17	8,833 8	1,902 3	..	..	..
Hart's Aberdare No. 4	..	..	972 10	14,391 5	6,198 16	6,273 16
Klondyke	5,673 0	5,716 0	6,158 1	7,441 18	9,206 11	12,443 0
New Aberdare	18,803 6	17,630 14	21,462 8	1,567 10	..	..
New Aberdare East	16,159 9	17,581 4	15,646 2	2,497 9	..	..
New Aberdare East No. 3 Tunnel	..	..	..	10,687 16	12,435 4	10,723 16
New Aberdare East No. 1 Tunnel	..	..	..	3,633 5	..	..
New Ebbw Vale No. 3	11,593 2	15,443 9	13,772 16	20,235 6	22,618 10	26,459 4
New Eclipse	2,315 15	2,018 0	2,633 1	1,924 15	..	..
New Whitwood No. 1	6,450 17	8,380 18	8,685 6	11,114 15	11,391 14	..
Noblevale No. 1	22 11	2,589 11	..	..	..	..
Noblevale No. 1, No. 3 Tunnel	..	..	4,776 10	7,730 1	9,425 5	8,406 16
Noblevale No. 1, No. 2 Tunnel	6,643 1	6,915 10	7,449 18	..	..	..
Rhondda	61,464 14	66,270 16	69,897 11	79,903 13	76,856 14	77,774 19
Riverside No. 2	23,242 0	21,719 0	..	3,797 0	5,429 0	5,898 0
Riverside No. 3	..	..	26,219 0	18,571 0	10,947 0	12,009 0
Rothwell Haigh	6,355 7	5,281 0	5,901 11	4,476 4	..	..
Rothwell Haigh No. 2	..	..	..	..	..	166 0
Rylance No. 3	51,156 14	48,598 9	44,076 17	58,758 2	57,764 8	59,037 15
Rylance Aberdare	4,083 7	2,899 15	779 11	..	..	..
Rylance Abermain	..	..	..	..	..	313 2
Southern Cross No. 4	21,473 0	22,029 0	25,315 6	22,653 6	13,541 5	1,958 19
Southern Cross No. 6	..	..	3,273 2	5,959 2	17,402 18	30,417 5
Thistle No. 3	1,198 8	..	..	..	..	..
Thistle No. 4	..	1,899 13	2,160 14	2,883 7	3,544 19	4,369 18
United No. 1	2,873 4	5,653 10	9,003 9	8,056 8	11,118 14	12,216 2
United No. 2	..	10,101 11	12,081 5	11,899 9	5,762 2	..
United No. 4	43 2	..	..	..	..	..
United No. 5	9,299 1	2,766 10	6,943 12	6,505 15	10,585 1	12,520 16
United No. 5 Extended	..	..	..	..	..	887 2
Whitwood No. 2	..	..	..	..	..	12,185 9
Whitwood No. 3	13,124 16	15,153 8	14,084 6	19,106 7	18,816 9	19,669 11
Total	484,331 14	467,598 3	508,559 18	555,452 14	562,648 0	575,521 12

gathered as to the variation of coal in a number of the seams from which it is permissible in some cases to predict the distance from the outcrop to which a seam may be worked. Often, however, there is no guide as to the likely changes that may affect the seam ahead of the working face, and in estimating reserves I have taken half-a-mile from the outcrop as the limit to which workable coal may be counted on, unless there is proof that it extends further. In no case has a seam been assumed to continue laterally more than five chains beyond the proved outcrop.

So far as the Tivoli coals are concerned there is reason to believe that workable coal will be found to persist beyond the existing colliery faces and, in places, well beyond the limit of half-a-mile from the outcrop. There is, however, no official record of the condition of any of the seams at the lowest faces in the various abandoned collieries and it cannot be assumed that the seams were still workable. On the other hand, there is no evidence of any *general* deterioration of the coal to the dip and there is no geological reason for expecting it. On the contrary, going south from the existing collieries one is approaching the centre of the basin, and it would not be surprising if the coal showed some improvement in this direction. The limiting factor in the extension of the pits south of the Bremer River may, after all, prove to be weight of overburden rather than deterioration of the coal. The upper Tivoli seams are considered to lie no more than 600 to 700 ft. below the surface in portions 253 to 256, Goodna (south of Ebbw Vale), and they may prove to be workable in this area.

Regarding the Aberdare Seam it should be emphasised that all the possible reserves are deep-seated; and, because of the well-known difficulty of working the coal under more than 800 or 900 ft. of cover, only a small proportion of the coal is likely to be recoverable.

Reserves of Bluff coal have been estimated only for the area between *Mafeking* and *Palmer's Aberdare*. I believe, however, that the time may come

when the Bluff Seam will receive attention in other areas, particulary in the old *Box Flat Colliery* and in the Dinmore district where it is at present regarded by colliery proprietors as unworkable.

Little West Moreton Seam. Possible reserves—300,000 tons.

Aberdare Seam. Positive Reserves (Pillars)—1,500,000 tons. Possible Reserves—4,500,000 tons.

Bluff Seam. Positive Reserves (Pillars)—250,000 tons. Probable Reserves—5 million tons. Possible Reserves—7½ million tons.

Seam between Bluff and Four Foot. Positive Reserves (Pillars)—70,000 tons. Possible Reserves—1,000,000 tons.

Four Foot Seam. Positive Reserves (Pillars)—350,000 tons. Possible Reserves—2,000,000 tons.

Bergin's Seam. Positive Reserves (Pillars)—250,000 tons. Possible Reserves—2, 100,000 tons.

Striped Bacon Seam. Positive Reserves (Pillars)—300,000 tons. Possible Reserves—1,600,000 tons.

Rob Roy Seam. Positive Reserves (Pillars, etc.)—60,000 tons. Possible Reserves—2,500,000 tons.

Braeside Seams. Possible Reserves—100,000 tons.

Seam in New Redbank Colliery (south-west of pit)—Possible Reserves—500,000 tons.

Riverside No. 1 *Seam.* Positive Reserves (Pillars)—70,000 tons.

Riverside No. 2 *Seam.* Positive Reserves—10,000 tons. Possible Reserves—500,000 tons.

Garden Seam. Possible Reserves (Limit ½ mile from outcrop)—700,000 tons.

Tantivy Seam. Possible Reserves (Limit ½ mile from outcrop)—350,000 tons.

Fiery Seam (*Haighmoor Seams*). Positive Reserves (Pillars, etc.)—210,000 tons. Possible Reserves (limit ½ mile from outcrop)—1,500,000 tons.

Waterstown Seam. Possible Reserves (Limit ½ mile from outcrop)—100,000 tons. (Heavily discounted because no information as to extent of old workings).

Tivoli Seam. Between Gulland's Fault and Mihi Creek only. Possible Reserves (Limit ½ mile from outcrop)—700,000 tons.

Eclipse Seam. Positive Reserves (Pillars, etc.)—130,000 tons. Possible Reserves (Limit ½ mile from outcrop, except in Rylance Abermain Colliery)—1,800,000 tons.

Benley Seam (2 sections). Positive Reserves—nil. Possible Reserves (Limit ½ mile from outcrop)—1,800,000 tons.

	Tons.
Total Positive Reserves (Chiefly Pillars)	3,200,000
Total Probable Reserves	5,000,000
Total Possible Reserves	29,550,000
Grand Total ..	37,750,000

PART II.—DETAILED LOCAL GEOLOGY.

CHAPTER 9.

THE NORTH IPSWICH AREA EAST OF SANDY CREEK.

Portions 57, 58, *Chuwar.* The Waterworks Seam has been prospected by some shallow workings and by a shaft, estimated from the spoil dump to be some forty feet deep. The shaft has collapsed but the dump contains some small fragments of good quality coal. In the shallow workings only thin bands of coal were seen interbedded with carbonaceous and light-coloured shale.

The complete disappearance of the seam east of these portions presents an unsolved mystery. A prolonged search in a number of wide arcs to the north and east showed nothing but sandy soil or outcropping sandstone, except in the road between portions 21A and 56, where a lens of outcropping coal about a foot thick is overlain by a thin shale section containing numerous plant fossils.

Portion 11, *Chuwar.* Cliffs of massive sandstone overlook the Bremer River along the greater part of the frontage in this block. At the base of the cliff near the boundary of portion 10 there is an old tunnel driven in a seam of coal, which, owing to the collapse of the tunnel mouth, is not now visible. Above the cliff a shaft, too deep to be plumbed by a one-chain tape, has been sunk through the sandstone to coal. I am informed that the work was done by Stafford Brothers in the early years of this century and that the shaft and tunnel are not connected. A sample of the better-looking coal in the spoil dump below the tunnel showed only 16·4 per cent. ash. In view of the moderately good quality of some of the coal and of the advantageous position of the tunnel above the level of ordinary floods the re-opening of the tunnel to enable an inspection of the seam would appear to be warranted. I estimate the horizon of this seam to be about the middle of the Abermain productive beds.

Haighmoor Colliery.—Worked originally by Lindsay Brothers as the *Rossend Mine,* the property later (prior to 1900) came into the hands of Stafford Brothers who worked it until 1909. The pit then lay idle for 35 years. In 1944 the property was purchased by the New Ebbw Vale Coal Company. The task of reconditioning the old workings was immediately put in hand and the colliery resumed production in the following year. The main workings are situated in portion 1, but there is an old tunnel (completely collapsed at the entrance) and shaft in portion 2. I could learn nothing authentic of the workings in portion 2 but coal was evidently worked there, for the tunnel was connected with the chutes at the Bremer River by a tramway which joins the main tramway from *Haighmoor* Shaft.

Three seams have been worked—the uppermost (of which nothing is known) by two tunnels near the western boundary of portion 1, and the other two (known as the top and bottom seams) by tunnels which are connected with a vertical shaft. Coal is hauled to the surface through the tunnel on the bottom seam. Present output which comes wholly from No. 3 Seam is about 100 tons a day.

The top seam in the main workings is separated from No. 3 by 9 ft. 6 in. of shale and 6 ft. of coaly measures. In the upper part of the tunnel the seam was 3 ft. 9 in. thick including a "badger" 7 in. thick, but below the shaft bottom (that is, about eight chains from the tunnel entrance) there is a section of coal 4 ft. to 4 ft. 6 in. thick underlying this section and separated from it by 12 to 18 in. of coal and stone bands. This bottom section carries two stone bands aggregating three inches and the coal is of somewhat better quality than the top section. It is reported that boreholes showed this section of the seam to be absent in the upper portions of the tunnel.

The bottom seam as originally worked varies from 4 ft. to 4 ft. 6 in. in thickness. It includes one or two thin lenticular stone bands and a "badger" from five to nine inches thick. Below this section there are stone and coal bands for seven to nine inches and then eighteen inches of coal, which includes a lenticular stone band seven inches from the bottom. On the average the quality of the coal in the top seam is somewhat below that of the bottom seam. Actual burning tests at the Mount Crosby Pumping Station are reported to show 18 to 19 per cent. ash.

The Haighmoor top and bottom seams are tentatively correlated with the Fiery Seam. They undoubtedly occupy a similar stratigraphic position to the latter but no close comparison of the sections can be made. The aggregate thickness of the two Haighmoor seams, including the coaly measures but not the 9 ft. 6 in. of shale between them, is 22 ft. while that of the Fiery Seam in Rylance Abermain Colliery is 23 ft. It may be objected that the existence of 9 ft. 6 in. of shale between the two Haighmoor seams vitiates the correlation. Splitting of seams on the Ipswich field, however, is not unusual. In fact a split in this particular seam has been observed further west in portion 72, Chuwar, the intervening shale and sandstone growing to at least 30 ft. No coal has been seen in the position where the Waterstown Seam should be but there are no natural exposures in the position where this seam may be expected to outcrop, and there is no evidence that any search has been made for it either at the surface or underground. In portion 62 nearby a seam 2 ft. 6 in. thick outcrops some 30 ft. below the Haighmoor bottom seam. This may possibly be the Waterstown Seam.

So far as the workings have extended no faults or dykes have been encountered. The roofs of both seams are good and the coal, on account of its soft nature, is easy to work. Both seams have shown an improvement to the dip and substantial reserves seem assured. The Company holds some 1,700 acres of country east and south of the colliery approximately half of which is possibly underlain by Nos. 2 and 3 Seams. It is, perhaps, too much to expect that these seams will be workable over the entire area in which they may occur; but within the boundaries of portions 1 and 2 alone reserves are approximately one million tons. The lower seams (Tivoli and Eclipse) underlie an even larger area within the Company's property and these, though scarcely workable at the outcrop north of the property, may improve down dip, and should be tested by diamond drilling.

Portion 177, *Chuwar* (*Morris' Tunnel*). This tunnel is situated just about on the western boundary of portion 177. It is completely closed at the mouth and nothing can be seen of the outcrop of the seam. Cameron (1911) described the seam in this tunnel as a rather stony coal 2 ft. 3 in. thick with two stone bands. A quantity of coal is lying near the mouth of the tunnel and it is of very good quality. The seam is considered to be a section of the Benley Seam.

Portion 176, *Chuwar* (*Morris' Tunnel*). Mr. Cameron (1911) shows a tunnel near the north-western corner of portion 176 on the "Big" (Waterworks) Seam which terminates against a fault some three chains from the entrance. The writer descended this tunnel for a distance of 175 yards where the way was blocked by debris washed down by rain water. There is a decomposed (?) basaltic dyke three chains down which is not associated with any dislocation of the coal. The seam is not the Waterworks Seam but a big unnamed seam lying approximately 150 ft. above it. As exposed in the tunnel the seam consists of alternating bands of "bluey" and stone with streaks of coal up to half-an-inch thick.

It might be mentioned here that confusion of this seam, and also of the "seam" in the Tuff Beds, with the Waterworks Seam prompted Cameron to postulate a number of major faults in this area which are now proved to be non-existent.

Portion 175, *Chuwar*. Mr. Cameron's plan (1911) shows a tunnel on the Tivoli Seam in portion 175. This seam is the Eclipse, the crop of the Tivoli Seam showing on the road about five chains to the south. The seam as exposed in the tunnel is 7 ft. thick and consists of bands of "bluey" and stone with bands of coal half-an-inch or less in thickness.

Outcrop of Tivoli Seam, Sandy Creek, North Ipswich.

[*Photo.—A. M. McKenzie.*

Eclipse No. 4 Colliery (abandoned).—The workings are situated in portions 134, 135, 140, Chuwar. The seams worked are the Eclipse and Tivoli. The mine was originally known as *Davis's*, but later (in 1901) became known as the Bremer Colliery. The latter does not appear to have been worked for more than a year or two. John Wright and Company renamed it *Eclipse No.* 4. It was abandoned in 1926.

The Eclipse Seam was worked to a slight extent in portion 140. The worked section of the seam was 3 ft. 2 in. thick and included three stone bands aggregating 2½ in. The coal consists of alternating bands of "bluey" and bright coal. Over the worked section there are twelve inches of inferior coal and, succeeding that, six feet of coaly measures.

The outcrop of the bottom section of the Tivoli Seam is well displayed in the left bank of Sandy Creek but the top section is obscured by debris from the superincumbent pebbly sandstone. Wright's Tunnel on the bottom section is blocked but it is still possible to squeeze into an old tunnel (believed to be Davis's) on the top section. The seam lies immediately under the pebbly sandstone and is about three feet thick, including four stone bands aggregating five inches.

Under the top section there are eight to ten feet of shale and then the bottom section which is five feet thick. It is reported that only the bottom three feet of the section was worked. In an old tunnel five chains to the east the worked section is only 2 ft. 5 in. thick.

The mine is situated not far from the Boxwood Fault, and the western levels extend to the troubled ground associated with the fault just beyond Sandy Creek.

The **Dolly Varden** shaft in portion 134 (not to be confused with the *Dolly Varden Tunnel* in portion 79, Chuwar) met the Tivoli Seam at a depth of 70 ft., but the seam here was almost in the Boxwood Fault and was only worked to a small extent. From the shaft bottom a bore was continued to a depth of 350 ft. without intersecting any coal, the Eclipse Seam evidently being thrown out by the Boxwood Fault.

Future prospects of this colliery lie in the development of the Tivoli Seam to the east and south-east of the present workings. The coal in the bottom section is of good quality but the seam is rather thin for profitable working. The shale between the tops and the bottoms is very much thicker here than elsewhere; but it may possibly decrease sufficiently to enable the two sections of the seam to be worked together. Diamond drilling in, say, portion 62 would yield much useful information.

Portion 36, *Chuwar* (*Bell Tunnel, &c.*). The *Bell Tunnel* is driven on the Haighmoor bottom seam. The workings are still partially accessible though the pit reportedly closed down more than sixty years ago. The course of an old tramway from the tunnel to the river may still be discerned and the ruins of the old chutes at the river bank are still standing.

Only the top section of the seam was worked as far as I was able to penetrate the workings. It is 3 ft. 3 in. thick and includes a "badger" 11 in. thick. The roof is pebbly sandstone. The workings are reported to be connected with the workings on the same seam in *Haighmoor*. In the air shaft the crop of a seam of coal 15 in. thick can be seen just below the surface.

Towards Sandy Creek there is an old trial tunnel, now closed at the entrance, on the uppermost of the Haighmoor seams. A pothole nearby shows five feet of croppy coal and carbonaceous shale. The strata between here and the *Bell Tunnel* consist of massive sandstone with thin shale beds.

Portion 62, *Chuwar*. The coarse sandstone overlying the Haighmoor top seam may be traced past the Bell Tunnel into portion 62 where it terminates against the Boxwood Fault. There is an old trial tunnel on the Haighmoor bottom seam driven some twenty years ago by Mr. A. Wright. The total thickness of the seam, as exposed at the mouth of the tunnel, is 9 ft. but the best of the coal is found in the bottom 4 ft. 3 in. where, however, there are 11 in. of stone in three bands and five inches of "bluey." The seam is thus scarcely workable but it is considered worthy of further development as it would not need much improvement to make it a workable seam, and the coal recovered would go a long way towards recouping the cost of mining.

A second tunnel nearby was reported by Mr. Wright to have been driven on a higher seam which, though it does not immediately underlie the sandstone, is probably the Haighmoor top seam. This tunnel is closed at the mouth.

About 30 ft. below Haighmoor bottom seam there is exposed in a small gully the crop of a seam 2 ft. 6 in. thick which may be the Waterstown Seam.

CHAPTER 10.

THE NORTH IPSWICH AREA WEST OF SANDY CREEK.

Boxwood Colliery (abandoned).—There are five old tunnels on the Eclipse Seam in what was once the *Boxwood Colliery* property. Very little can be learned of the history of the colliery which, except for a brief period some fifteen years ago, has not been active since the beginning of the century. The official records show that the pit was working in 1895.

The tunnels are driven on the outcrop of the Eclipse Seam in the disturbed country adjacent to the Boxwood Fault. Cameron (1923) has mapped two faults between the Boxwood and Bishop Faults.

The worked section of the seam, as exposed in one of the tunnels, is five feet thick and includes two stone bands near the middle of the section. Above this section there are 2 ft. 10 in. of coal with three stone bands. Since the old colliery was abandoned some attempt has been made to work the tops and the bottoms, apparently without much success.

Under the influence of the Boxwood Fault the seam here strikes north-south and dips to the east at 1 in 1. The workings cannot have been very extensive as they would have come up against the Boxwood Fault to the north and east and the Donnybrook workings to the south.

Besides the tunnels there is a trial shaft (now collapsed) sunk in the pavement of the Eclipse Seam which shows no coal in the spoil dump.

Eclipse No. 2 ("Donnybrook") Colliery (abandoned).—This colliery lies to the south of the Boxwood pit. The workings lie between the Bishop Fault on one side and the Boxwood Fault and one of its branches on the other. The only seam worked was the Eclipse but the Benley Seam was prospected by a shaft and tunnel. The colliery was known originally as the *Donnybrook*, and after being abandoned for some years was reopened as the *Penstone* but was subsequently registered as *Eclipse No.* 2.

It is reported that the Eclipse Seam here carried some very fine coal and that both "tops" and "bottoms," not usually worked at that time, were exploited. Cameron (1899) shows the section of the seam as worked in this pit to be 11 ft. 1 in. thick, including two stone bands of an aggregate thickness of four inches.

The strata are folded between the two fault systems hereabouts, and as a result of a syncline with a northerly pitch the seam comes to the surface again in portion 134, some 33 chains ahead of the main tunnel. A sharp anticlinal fold takes it beneath the surface again in portion 63.

The complete section of the Benley Seam is not now visible. The tunnel shows a 5 ft. seam consisting of coal and stone bands under a sandstone roof. This is succeeded by 4 ft. 6 in. of black shale under which the bottoms are partially visible. Of the 3 ft. 3 in. section of bottoms exposed 12 in. are stone and "bluey." The coal itself, though including some good bands, is generally inferior, and the section does not appear to be workable.

The Tivoli Seam has not been found overlying the Eclipse Seam in the "Donnybrook" fault block. The reason for this is not apparent as there must at the deepest point in the workings be at least 200 ft. of cover over the Eclipse Seam, which is much in excess of the greatest known thickness of strata separating the two seams. It is, of course, possible that the sandstone between the seams may be abnormally thick hereabouts and the seam removed by denudation.

Nil Desperandum Colliery (abandoned).—This tunnel, which lies at no great distance from the *Donnybrook* opening, was driven by G. Ware on the Eclipse Seam and was reported by Cameron (1899) to have at one time sent out a considerable quantity of coal. The workings, lying as they do between the *Donnybrook* workings and the Bishop Fault, could not have been extensive.

Eclipse and Bishop Collieries (abandoned).—The seams worked are the Waterstown, Tivoli, and Eclipse. The property comprises portions 63, 64, 65, 66, Chuwar.

The Waterstown Seam crops out about five chains inside the south-eastern boundary of the property and the workings on it are not extensive. In his 1899 report Cameron states that the tunnel in portion 64 was driven to the Waterstown Seam through the Bishop Fault. On the other hand the 1923 map shows the tunnel to be driven on the outcrop of the seam on the north-east side of the fault, but not through the fault. The tunnel has fallen in but a careful search of the vicinity failed to reveal any sign of the seam and I have come to the conclusion that the earlier interpretation is the correct one and that the Waterstown Seam has not yet been located between the Bishop and Boxwood Faults.

The Tivoli Seam was worked from a tunnel driven from the outcrop. This tunnel was known as the "*Stone Quarry*" because at and near the outcrop it carried a stone band which entirely replaced the bottom section of the seam, leaving only 1 ft. 4 in. of coal on top. The tunnel was driven on the half-dip and approached the Tivoli Fault as it went down. The bottom coal rapidly increased in thickness in this direction and where measured by me in the first level to the south-west (recently drained as a result of pumping operations in *Rylance Abermain Tunnel*) was 2 ft. 4 in. thick, while the stone was reduced to 1 ft. 4 in. and carried a good deal of coal. The late Mr. A. Wright, proprietor of the mine, stated that the increase in the thickness of the stone band and accompanying deterioration of the coal going

north-east (*i.e.*, away from the Tivoli Fault) were general throughout the mine. The seam is reported to be worked out to the south-eastern boundary in the south-western portion of the property.

The Eclipse Seam is reported to have been of good quality throughout the property. It was originally worked from two tunnels towards the northern boundaries of portions 65 and 66 and also from the *Bishop Tunnel* in portion 63. The former were destroyed in the flood of 1893, but subsequently the seam was exploited below the level of these workings by a vertical shaft and by a tunnel driven through the overlying measures from the outcrop of the Tivoli Seam. As worked in this property the Eclipse Seam is on the average 5 ft. 6 in. thick with a stone band (which invariably carries a band of coal) 6 to 8 in. thick. Actually the seam is very much thicker than this, and recently the full section of 14 ft. has been exploited from the newly-opened *Rothwell Haigh No. 3 Tunnel* at the south-western end of the property.

Apart from the Bishop Fault (against which the Bishop workings terminated) only two faults are shown on the plans. These two apparently related faults occur in the south-western end of portion 64 and pass through the south corner of portion 63, but they appear to die out in portion 65 as they are not shown on the plan of the old workings in that block. The two faults converge going east and apparently unite approaching the College's Crossing Road, where the presence of a fault at the surface is to be inferred from the abrupt change from shale to massive sandstone.

The Eclipse Seam has not been worked extensively between the Bishop and Boxwood Faults in this property, but I understand that the country was badly disturbed and the inclination of the seam very steep, and it became difficult to handle.

The seam does not appear to have been worked in portion 64, except in the south-eastern extremity. There are some ten acres of unworked ground here containing perhaps 65,000 tons of coal. Like most North Ipswich pits, the Eclipse Collieries were equipped with coke ovens. The Benley Seam was opened up by a tunnel driven on the outcrop in portion 102 and worked to a small extent, but there is no record of the thickness or quality of the coal.

Bindley Colliery (abandoned).—This is one of three small collieries on the Benley Seam. It was operated by G. Ware for a few years prior to the turn of the century and lay idle until 1927 when the Metropolitan Coal Company drove a new tunnel and erected coke ovens. This venture was not successful, however, and the pit was abandoned soon after.

The Benley Seam was worked in two sections by the Metropolitan Coal Company, the lower section having a thickness of 3 ft. 2 in. and the upper of 4 ft. 1 in. The two sections are separated by three feet of stone and coal bands.

Sharp fold in shale revealed by sheet erosion following removal of timber.
Locality: Portion 133, Parish of Chuwar (near old Bishop Colliery).

[*Photo.*—*A. M. McKenzie.*

Cameron (1899), quoting the manager, Mr. Harris, stated that the seam was in three sections. The top section, which was 3 ft. thick, was separated from the middle section (thickness 4 ft. 3 in.) by ten feet of shale, the bottom section being 5 ft. below the pavement of the middle section. He gave the thickness of the bottom section as 4 ft.

The coal is somewhat inferior but with careful mining it is considered a marketable article could be produced.

Glencoe Colliery (abandoned).—The tunnel entrance is situated in the south-eastern part of portion 46 (opposite portion 70). The colliery was worked by G. Ware about the change of the century. In 1913 the Glencoe Coal and Coke Company acquired 156 acres of land, presumably including this colliery, but there is no evidence that the company actually worked the pit.

The tunnel is now completely blocked at the mouth and nothing is to be seen of the coal.

The crop of the coal can be traced from the *Glencoe Tunnel* to within a few chains of the *Bindley Tunnel.* It diverges considerably from the line of outcrop shown on Cameron's map, indicating a diminution in the magnitude of the Tivoli Fault in this direction.

Rylance Abermain Colliery.—The property includes the north-eastern portion of the old Abermain Colliery and lies to the dip of the Eclipse Colliery workings.

A tunnel was commenced in the sandstone overlying the Fiery Seam and driven in a direction approximately parallel with the dip of the strata at a grade of 1 in 3. After passing through the Fiery, Waterstown, and Tivoli Seams, it bottomed on the Eclipse Seam in September 1944, at a vertical depth of 425 ft. Development has been on a small scale pending the completion of the air tunnel, which is being driven on a grade of 1 in 2.

The Fiery Seam, which has a roof of coarse sandstone, is here 23 ft. thick. The section carries a large number of stone bands most of which are two inches or more thick. No coal band exceeds eleven inches in thickness, and much of the coal is inferior.

The Waterstown Seam, which was intersected at a vertical depth of 105 ft., has a working section of 2 ft. 4½ in. including a stone band 1½ in. thick. There were old workings here, evidently belonging to the Abermain Company. The workings are not shown on the Abermain plans, and their extent is unknown. Though rather small, the seam is of good quality, and it is proposed later to investigate the old workings and to work any coal still standing intact.

The Tivoli Seam lies at a vertical depth of 320 ft. It is separated from the Waterstown Seam by massive sandstone and a little shale. The sandstone is coarse and pebbly and is characterised by the presence of a number of vertical joints some of which are lined with crystalline calcite (usually accompanied by a little pyrite). These joints yielded prodigious quantities of water, but one after another they have ceased to flow. It was found subsequently that they were draining Wright's old workings on both Tivoli and Eclipse Seams to the north-west.

The Tivoli Seam is 4 ft. 6 in. thick but of this less than one-half is coal. The coal is of good quality and it is proposed later to prospect the seam further afield in the hope of locating a workable area of coal. Experience in Wright's Colliery leads one to expect that workable coal will be found approaching the Tivoli Fault.

The Eclipse Seam lies 104 ft. below the Tivoli. The whole seam is 13 ft. from roof to pavement, but only the bottom five feet are considered to be workable under present conditions. This section carries the usual double stone in the middle, otherwise it is without bands.

A double road is laid in the tunnel, and later an endless haulage is to be installed. One anticipates a steady output of steam and coking coal from this pit for many years to come. Reserves are estimated in round numbers at one and a-half million tons.

Rothwell Haigh Colliery.—This property, which is part of J. Gulland's original Tivoli Estate, embraces portions 67, 68, 71, 72, Chuwar. Gulland's property seems to have extended some distance to the south-east to take in the outcrops of the Garden and Tantivy Seams on Tivoli Hill. Three seams have been worked in the colliery as now constituted, *viz.* the Waterstown, the Tivoli, and the Eclipse.

The property was first worked for coal about 1870, the Tivoli Seam being exploited. On completion of the Brisbane-Ipswich railway Gulland shifted his activities to Dinmore where connection with the railway considerably reduced freight costs. The Tivoli property lay idle for some years, but was eventually acquired by Stafford Brothers in 1898. It was operated under Staffords' ownership until 1926 when it was purchased by Darker Brothers. For some years mining has been concentrated on the Eclipse Seam. A fire caused the abandonment of the pit in 1941. The property was purchased in 1944 by United Collieries Pty. Ltd. Two old tunnels have been reopened—one on the Tivoli Seam and the other —*Rothwell Haigh No.* 3 (formerly known as the "*Sound Tunnel*")—on the Eclipse Seam on the north-eastern side of the Tivoli Fault. In the former there is nothing left to work but pillars and slack. The latter not being readily saleable at the time of working, was stowed in the old bords. In *Rothwell Haigh No.* 3 *Tunnel* they are working pillars as well as the top and bottom sections of the seam which had been left intact by the previous proprietors because of the inferiority of the coal. By arrange-

ment with the owners of *Eclipse Colliery* they have crossed into this property and are extracting what coal they can from the old workings.

The main *Rothwell Haigh* workings are bounded by two parallel dip faults—the Tivoli Fault on the north-east and a dislocation which I have called Gulland's Fault on the south-west. In both cases the downthrow is to the north-east though the Tivoli is by far the larger fault.

The Waterstown Seam as exposed in the "Echo" Tunnel in portion 72 has a working section of three feet which includes a stone band one inch thick thirteen inches from the roof. So far as can be learned, the seam was worked to the south-eastern boundary of the property but it is not known if it was worked beyond Gulland's Fault.

The Tivoli was a grand seam of coal in Rothwell Haigh. As measured in one of Gulland's old tunnels it was 5 ft. 5 in. thick and included a "badger" ten inches thick and two stone bands, respectively two inches and half-an-inch thick. Approaching the Tivoli Fault the seam thickens and so does the "badger," while in the opposite direction the bottoms decrease both in size and quality and the "badger" is reduced to a single shale band one inch thick. As measured near Gulland's Fault the seam was 3 ft. 10 in. thick and included one stone band one inch thick.

There is an old tunnel driven by Stafford Brothers in portion 71 on the south-western side of Gulland's Fault which, because of foul air, could only be hastily inspected. It is reported that the coal between the fault and Greasley Street (the southern boundary) is almost intact. The seam in this tunnel is 3 ft. 7 in. thick with one band of stone one inch thick.

The crop of the Eclipse Seam is well displayed in Allen Street between portions 70 and 71, but the unweathered seam cannot now be seen between the two faults. The coal is said to have been somewhat inferior as compared with the section worked north-east of the Tivoli Fault and to have deteriorated to the dip.

In No. 3 Tunnel, which is on the north-eastern side of the Tivoli Fault, the section previously worked was 4 ft. thick with the double stone 2 ft. 3 in. from the floor. Where practicable they are now mining the entire section of the seam which is 14 ft. thick though this includes a good deal of inferior coal.

The three seams already exploited in Rothwell Haigh are virtually worked out. It is unlikely that the main Eclipse workings will be reopened as the extraction of pillars had already reached a fairly advanced stage before fire caused the abandonment of the pit. It may be possible to extract a good deal of coal from No. 3 Tunnel, but operations there are in the nature of salvage and may be brought to a sudden stop by a creep. So far as the Tivoli and Waterstown Seams are concerned only stowed slack and pillars remain to be extracted. The Benley Seam underlies the whole property. Though not of high quality where opened up at the outcrop the seam was workable. The probable available tonnage from the middle section alone would be of the order of half a million tons. Testing by diamond drilling should precede any attempt to exploit the seam.

Abermain Colliery (abandoned).—The property lies to the dip of the Rothwell Haigh Colliery. All the North Ipswich seams from the Eclipse up have been worked to a greater or less extent. It was known originally as the **Waterstown Estate** but the name was altered when the property was purchased by W. R. Black in 1906. For many years the coal was hauled to the Bremer River on a light tramway from where it was loaded into punts for carriage to Brisbane. In 1913 a siding was carried in to the pit from the Mount Crosby Railway and the use of punts was discontinued.

The first seam worked was the Garden (about 1870), which received its name from the fact that the first tunnel, known as the Garden Tunnel, was started in proximity to a market garden. There are two other old tunnels on the Garden Seam, the **Engine Tunnel** and the **Dolly Varden Tunnel.** All have collapsed at the entrance. Workings on the Garden Seam are reported to extend 250 yards from the outcrop.

The Tantivy Seam was worked from a tunnel marked "**Edna**" Tunnel on the 1923 map (more likely the name is "**Edina**"). Though still open for a chain or two the tunnel has caved badly and the seam is largely obscured by fallen rock. The workings are probably not extensive.

About 1885 a vertical shaft was sunk to reach the Waterstown and Tivoli Seams which come to the surface in the neighbouring *Rothwell Haigh* property. At first the shaft stopped at the Waterstown Seam but subsequently it was put down to the Tivoli Seam and later still (under the ownership of W. R. Black) to the Eclipse Seam, which was intersected at a vertical depth of 622 ft. The depths at which the other seams were intersected are in some doubt. In his 1899 report Cameron gives the depths as follows:—

Tantivy	40 ft.
Fiery	270 ft.
Waterstown	320 ft.
Tivoli	579 ft.

In the subsequent unpublished eight-chain map the depths are given as:—

Tantivy	80 ft.
Fiery	250 ft.
Waterstown	300 ft.
Tivoli	544 ft.

There is no information available concerning the Tantivy and Fiery Seams, as met with in the shaft.

The Waterstown Seam was 3 ft. 7 in. thick with two bands of stone respectively one inch and two inches thick, according to Cameron (1899). Fryar (1900) says that the thickness diminished to 3 ft. or less in the deeper south-western workings. The coal is said to have been of good quality.

The Tivoli Seam, according to Cameron (1899), had a working section 4 ft. 9½ in. with two bands aggregating one-and-a-half inches. The workings on the Tivoli Seam were very extensive and reached across the Bremer River in portion 5, Ipswich, the vertical depth at this point being approximately 1,000 ft. There is no evidence that the seam was worked north-east of the Tivoli Fault.

The Eclipse Seam was found to be very inferior and it was worked only to a very small extent. Shortly before the abandonment of the colliery a stone drive was put through the Tivoli Fault and an area of about twelve acres of the Eclipse Seam was worked. The quality of the seam is reported to have shown a striking improvement after they passed through the fault. These workings are some ten chains to the dip of the present workings in *Rylance Abermain Colliery*.

The Waterstown and Tivoli Seams appear to be virtually worked out in that portion of the property lying south-west of the Tivoli Fault and north of the Bremer River. There is nothing to suggest that they do not persist as workable seams across the river or in the Moore's Pocket area. I know of no technical difficulties in the way of working these seams at greater depths than those already reached; so that reserves of deep-seated coal beyond the limits of the existing workings may be very considerable. Apart from these two seams there are possibilities in the Garden and Tantivy Seams, but the position is indefinite owing to the scanty available information as to the extent of the workings and the nature and thickness of the seams.

New Eclipse Colliery (abandoned).—This property comprises a group of small portions on both sides of the Mount Crosby Railway between Albert Street and Hill Street. It was originally known as the **Liverpool Colliery** and it was opened up prior to 1888. With the exception of a short period when it was worked by the Ipswich and Rosewood Coal and Coke Company, the colliery had been abandoned for a good many years when reopened in 1929 by J. Yule. It was abandoned by Mr. Yule in 1942.

Four seams crop out in the property and three have been worked. Fryar (1900) states that two seams were worked in the *Liverpool Colliery* one of which is described as being four feet thick with a thin band of shale one foot from the top. "The coal," he says. "made excellent coke, and was a bright cheery coal in the furnace." This description does not fit the seam on which *Yule's Tunnel* is driven nor does it apply to the overlying seam. The third seam, which I believe to be the Waterstown, is not now visible. The fourth and uppermost seam which, on account of its thickness and banded character is correlated with the Fiery Seam, has not been prospected below the surface.

The identity of the two lower seams is uncertain. They lie between the Eclipse and Waterstown Seams, but, because of the distance separating them from the seams in *Rothwell Haigh Colliery* (some 20 chains) and paucity of exposures in the interval, it cannot be positively asserted that either one of them is the Tivoli Seam. Nevertheless, I tentatively correlate the lower of the two seams cropping out in portions 108 and 109 with the Tivoli Seam. If this correlation be correct the seams must take a fairly sharp bend between the *Rothwell Haigh* and *New Eclipse Collieries*. Such a flexure does in fact take place in the higher seams.

The identity of the seam in *McQuade's Tunnel* in portion 112 (not accessible) is in doubt. It may possibly be the Poverty which is believed to make its appearance hereabouts.

The seam worked by Yule may be traced practically without interruption to the *Klondyke Colliery*, where it appears to be identical with the Top Seam. The Eclipse Seam is not traceable between Simpson Street (off Pine Mountain Road) and Gulland's Fault. The Waterstown and Fiery Seams cannot be traced west of the Mount Crosby Railway.

The seam worked in the *New Eclipse Colliery* was 3 ft. 4 in. thick and included three bands of stone and one of "bluey" which had an aggregate thickness of 8 in. The coal in the middle part of the seam was rather splinty though reported to burn well.

Forty feet above the seam just described there is a seam which, as exposed in a railway cutting near the pit, has the following section.

Shale Roof	
Coal	2 ft. 0 in.
Shale and Ironstone	8 ft. 0 in.
Coal	2 ft. 6 in.
Stone	0 ft. 2 in.
Coal	0 ft. 6 in.
Ironstone "Boulder"	0 ft. 6 in.
Coal, at least	0 ft. 6 in.

Cameron's eight-chain unpublished map shows a bore in portion 109 just behind the crop of the ?Tivoli Seam and records that coal was found at 33 ft., 120 ft., and 240 ft. Nothing is known as to the thickness or quality of the seams passed through nor as to the total depth of the bore.

The ?Tivoli Seam is by no means worked out here but the coal is not high-grade and does not command a ready market.

Too little is known of the two higher seams to enable their future possibilities to be assessed.

Tantivy Colliery (abandoned).—Stated by Fryar (1900) to have been worked periodically almost from the beginning of the coal-mining industry in Queensland, the Tantivy Tunnel on the seam of the same name was in 1896 re-opened by A.

Bennett, formerly manager of the *Waterstown Colliery,* and operated by him until 1906 when he abandoned it in favour of the *Belmont Colliery* at Riverview. It has not been worked since then.

The tunnel has collapsed at the mouth and no first-hand description of the seam can be given. It is known, however, that the working section of 3 ft. 4 in. included two stone bands aggregating five inches. In the roof there were ten inches of coaly shale and then eighteen inches of coal which was brushed in the wheeling roads.

The plan shows a fault crossing the tunnel 1½ chains from the entrance and throwing up the coal to the west-south-west, but no other dislocations.

Gulland's old tunnel on the Garden Seam lies in portion 169. Judging by the spoil dump the workings must be rather extensive. Not even the oldest resident of Tivoli Hill, however, can remember the time when this tunnel was working, and I could find no record of it, official or otherwise.

The Tantivy workings are not extensive, and there are moderately large possible reserves in this and the Garden Seam on the south side of the Bremer River.

Klondyke Colliery.—Worked in the early days of coal mining in the district as the **Eastwood Mine** and known later as the **Mihi Tunnel,** this pit was abandoned for many years until taken up by the present proprietors in the early nineteen-twenties. Previously (in 1912 and again in 1920) Paul Francis had opened up tunnels on a small seam underlying the Eclipse Seam and on the ?Tivoli Seam both of which he had worked in a small way.

At the moment the *Klondyke* is the only colliery in the field equipped with coke ovens. It is also provided with a screening plant and picking belt.

Five seams crop out within the property. These occur (in descending order) as follows:—

	Thickness. ft.	in.
?Waterstown Seam		?
Sandstone and Shale	150	0
Unnamed Seam	4	0
Pebbly Conglomerate and Shale ..	15	0
?Tivoli Seam	3	8
Shale	40	0
Poverty Seam	2	6
Chiefly Shale	48	0
Eclipse Seam	10	0
Shale and thin Sandstone	85	0
Francis' Seam	1	10

Only a glimpse of the uppermost of these seams is afforded in the approach of an old collapsed trial tunnel in Wyndham Street. If it should be the Waterstown Seam the thickness of the strata between it and the Tivoli Seam must diminish rapidly between here and *Rothwell Haigh* where the perpendicular distance between the two seams is 250 ft.

The unnamed seam above the "Top Seam" has not been worked but its outcrop rather suggests that it should be workable.

The "Top Seam" (?Tivoli) as exposed at the surface is 4 ft. thick but I understand that the usual working section was 3 ft. 6 in. or less. It has

View showing cliffs of Kholo Conglomerate on Brisbane River (right). At left, Mount Crosby Insect Shales are exposed under

been worked over an area of fifteen acres or thereabouts and there are still substantial reserves. There is no access to these workings.

The Poverty Seam as exposed in a trial tunnel is only twenty inches thick though the manager reports that elsewhere it was as much as 2 ft. 10 in. thick. I have not seen the unweathered coal, which is reported to be of good quality. A seam of coal outcropping in Mihi Creek three chains up from its junction with the Bremer River is thought from the mapping to be the Poverty.

The Eclipse Seam (known also as the Mihi) is some ten feet thick but until recently only 4 ft. 6 in. to 5 ft. of it was worked. Now they have commenced taking down the "tops" comprising 15 to 20 in. of somewhat inferior coal usually carrying some "bluey" and/or "boulder" and separated from the main section by eighteen inches of coaly shale. Underlying the worked section and separated from it by eleven to twelve inches of shale there is a band of coal a foot or so in thickness. The main section carries two bands of stone or "bluey" both of which vary from two to five inches.

The plan shows two faults one of which was visible at the time of my inspection. This is a normal fault with the usual north-west and south-east strike and a downthrow (where measured) of twelve feet. The other fault which strikes roughly east-north-east–west-south-west is reported to throw the seam down to the south-south-east by twenty feet. The coal has not been worked on the lower side of the fault.

Within the limits of the property the Eclipse Seam is virtually worked out with the exception of a small triangle of ground, nine acres in area, between the east-north-east–west-south-west—striking fault and the Railway Workshops Reserve. The seam underlies the whole of the Workshops Reserve (R.845) where there are estimated to be some 600,000 tons of coal. To the south-west the outcrop passes under the Bremer to reappear in Woodend Pocket where it is being worked by the New Ebbw Vale Coal Company.

Parish of Brassall (between Ironpot Creek and Toowoomba Road).—In the bed of Ironpot Creek some ten chains from its mouth there is a thin crop of coal dipping steeply to the south-west. A shaft (now filled with debris) has been sunk on the same seam in the bend of the creek in portion 455. The 1923 Cameron map shows two bores near the northern boundaries of portions 454 and 453 respectively, one of which is stated to have intersected two feet of coal at 28 ft. What may be the same seam crops out on the Toowoomba Road between portions 489 and 548. Mr. Cameron's mapping leaves no doubt that he considered this seam to be on the horizon of the Aberdare Seam. There is, however, no conglomerate overlying the seam in Ironpot Creek whereas there is a considerable thickness of silicified sandstone and conglomerate underlying it. In the Toowoomba Road section there is silicious grit overlying the seam but a very much greater thickness of conglomerate and grit under the seam. I consider this seam to be one of the lenticular seams known elsewhere to be interbedded in the upper part of the Aberdare Conglomerate.

ast Crosby Pumping Station (extreme left), and College's Crossing nglomerate (insect locality (1)).

[*Photo.—A. M. McKenzie.*

CHAPTER 11.
THE IPSWICH CITY AREA.

New Ebbw Vale No. 3 Colliery.—This colliery, which is situated in Woodend Pocket, is on the Eclipse Seam, and thus properly belongs to the North Ipswich group of mines. According to Fryar (1900) the pit was opened up first in the early days of the field by J. Ferrett. How long operations continued under Mr. Ferrett's ownership is not known but the pit was abandoned long before the turn of the century. It was re-opened some time in the early nineteen-thirties by A. Richards and party, from whom it was purchased in 1935 by the New Ebbw Vale Coal Company. The old tunnel was driven on the outcrop of the Eclipse Seam (not now visible) on the banks of the Bremer River. The dip at the outcrop is rather steep and the present proprietors have driven a new tunnel on a grade of 1 in 3 which passes through some 200 ft. of high-level river alluvium and coal measures before reaching the seam. In the accessible workings the seam dips flatly (about 1 in 12) to the south or south-east except in the right-hand cross dip where, as the result of a synclinal fold it dips north-north-easterly, at 1 in 4 for a distance of 70 yards. Minor faulting affects the coal to some extent and creates local problems in laying out the workings. Owing to difficulty in securing the coal rights of the numerous small freeholds existing in this closely settled area it has not yet been possible to work any coal north or east of the tunnel mouth.

The section of the seam is not very different from that in Klondyke Colliery, except that it is somewhat thicker. The main section has an average thickness of 5 ft. 6 in. There is a stone band four inches thick, six to ten inches from the roof, and a band of stony coal three feet from the pavement. The top section is rather thicker than in Klondyke Colliery, being 2 ft. 10 in. to 3 ft. 2 in. with only four inches of shale between it and the main section. It has been worked to a small extent but the coal is rather inferior. The "bottoms" which are about 2 ft. 6 in. thick are not of workable quality.

A second seam, worked to a small extent in the early days of the colliery, lies some 100 ft. above the Eclipse Seam. The old tunnel was re-opened by the present company and showed a seam 4 ft. 7 in. thick with five stone bands aggregating thirteen inches. It is not regarded by the company as a workable section.

The two seams can be traced at the outcrops along the bank of the river to a point a few chains west of Harlin Road, where they are abruptly truncated against the West Ipswich Fault. Down dip (*i.e.*, to the south and south-east) the strata are rather severely folded. This is not expected to impair the quality of the coal, though it will undoubtedly increase the difficulty of working it. Provided the company is able to secure the necessary mineral rights of the numerous small holdings ahead of the existing workings there is reason to anticipate a long life for the colliery.

Coal in Mary Street (between Sections LIII. and LIV.).—The crop of a seam is well displayed in the unused roadway between Sections LIII. and LIV. The following section was measured:—

	Thickness. ft.	in.
Coal and Stone	3	0
Coal	0	10
Stone	0	4
Coal	0	3½
Stone	0	2
Coal	0	4½
Stone	0	2
Coal	1	6
Stone	0	1½
Coal	0	4
Stone	0	1
Coal	0	7
Coal and Stone	2	0

The coal, though weathered, appears to be of good quality and the seam should be workable notwithstanding the rather frequent occurrence of stone bands. The exposure occurs on the axis of a pitching synclinal fold, the steeply dipping western limb of which would hamper its exploitation in the unoccupied northern half of the section. Probably considerable difficulty would be experienced in securing sufficient land to the dip (*i.e.*, to the south) to warrant opening up a colliery on the seam. The horizon is probably in the lower Cooneana Stage.

Noblevale No. 6 Colliery (embracing City Colliery) (abandoned).—This colliery lies on the southern slopes of Denmark Hill (350 ft.) whose heights dominate the city of Ipswich. The probability of the occurrence of the Aberdare Seam hereabouts was noted by W. E. Cameron in his 1907 report. In his Annual Report for 1912 (*see* Annual Report of the Department of Mines for 1912, p. 208), Cameron revealed that a detailed examination of the Denmark Hill area "disclosed the presence of a coarse conglomerate which gave every appearance of being identical with the conglomerate found over the Aberdare Seam at Blackstone." He subsequently discovered the crop of a large seam below the conglomerate, and this was opened up in the same year by the Ipswich and Rosewood Coal and Coke Company. Later a new company styled "Ipswich City Collieries Limited" was formed and the colliery named **City Colliery.** The property was purchased in 1919 by H. G. Noble Limited and renamed "Noblevale No. 6." A tunnel was driven due east obliquely to the strike of the seam for 32 chains, when a serious creep followed by fires necessitated the sealing off of the workings.

A cross dip was then driven in a south-south-easterly direction from near the mouth of the tunnel but this had not advanced more than eight or nine chains when an extensive washout was encountered. This at first affected only the upper portion of the seam, but as driving continued the erosion bit more deeply into the seam and finally eliminated it altogether. Subsequently, in 1933, a new tunnel, which was called "**Aberdare West,**" was begun in R.816 (Section CVII.). By 1940 it had reached a point 34 chains from the entrance when, owing to fires, the colliery was finally abandoned. Only a relatively small quantity of coal lying between the old main tunnel workings and the outcrop was won from this tunnel. Towards the bottom of the dip the coal was disturbed by faults and igneous dykes. There is now no access to any part of the colliery.

Proximity of the colliery to the West Ipswich Fault causes the beds to be folded (though not severely) and rather excessively faulted. J. H. Reid (unpublished report dated 15th March, 1928) observes that small overthrusts are frequent throughout the colliery—another manifestation of the tangential forces that operated in proximity to the great fault system of the Brisbane Valley. In the northern part of the property (*i.e.*, about the summit of Denmark Hill) dips observed at the surface are abnormally steep, ranging up to 50 degrees and averaging 45 degrees. Going south toward the main tunnel the strike swings to almost north-south and the dips flatten to 20 degrees to 25 degrees forming an open synclinal fold with a south-easterly pitch. There is no record of the dip of the seam in underground workings but to judge from surface exposures it must vary considerably, flattening to 1 in 5 in the extreme south-east.

The worked section of the seam is reported (W. E. Cameron, 1914A, and J. H. Reid (*loc. cit.*)) to have been eight feet thick with one stone band two inches thick and a number of penny bands. Above this section there was coaly shale of variable thickness (13 ft. is greatest thickness reported). Below it are the "Measures" or middle seam 6 to 7 ft. thick. This section, according to Reid, though rather banded, is predominantly coal and he considers the term "Measures" may be rather a misnomer. Below the "Measures" there is a bottom section 6 to 7 ft. thick, but nothing is known as to the quality of the coal. The entire section is 21 ft. thick.

Both Cameron and Reid noted that the section of the seam did not agree in detail with that of the Aberdare Seam at Blackstone, but they concluded from the size of the seam and the general geological conditions that the seam was without doubt the Aberdare Seam.

One cannot but agree with this conclusion, but a difficulty arises in attempting to correlate the worked section at Denmark Hill with the Aberdare "tops" due to the fact that the stone bands of the Aberdare "tops," which are remarkably constant wherever the seam has been opened up, cannot be recognised in the Denmark Hill Seam. For this reason I think it likely that the coal worked in the City Colliery is a locally workable section of the measures overlying the Aberdare Seam proper such as occur in the Blackheath Colliery, the "Measures" and "Bottoms" representing probably the Tops and Bottoms of the Aberdare Seam, so excessively banded as to be unworkable.

There are, besides the Aberdare Seam, three lower seams in *Noblevale No.* 6 property. The first ("City No. 2") lies 115 ft. below the Aberdare Seam. It outcrops in the gully in R.816 (where it is seen to be dislocated by a fault) and in a cutting in Park Street. Two trial tunnels have been driven on it, one of which is still open and shows the following section:—

	Thickness. ft.	in.
Sandstone roof		
Coal (good quality)	0	4½
Stone	0	1
Coal	0	3
Soft Coaly Shale	0	1
Coal	0	9
Stone	0	7
Coal	0	6
Stone	0	2
Coal	0	2
Total ..	2	11½

"City No. 3" Seam lies 285 ft. below the Aberdare Seam. It is exposed at the corner of Chelmsford Avenue and Outridge Street (shown on old maps as Watson Street), where it is disturbed by thrust faulting, and in R.816. It has not been seen at the surface beyond these limits. In the exposures in R.816 the seam has a thickness of 12 ft. or more and it looks as if it might be workable, at least in part. A trial shaft recently sunk at West Ipswich some distance ahead of the projected outcrop of this seam penetrated 17 ft. of coal and stone bands at 70 ft. The coal was mostly very inferior and the stone bands were numerous and up to twelve inches thick. This may be No. 3 Seam, but if so it must deteriorate badly going south-west from R.816. I consider the outcrop in R.816 well worth testing by a diamond drillhole or preferably by a shaft or tunnel.*

"No. 4" Seam crops out at the corner of Chelmsford Avenue and Clay Street. The crop is 5 ft. wide, indicating a true thickness of 3 ft. Nothing can be said as to the quality of the coal.

Nos. 2, 3, and 4 Seams cannot be identified, either by their sections or by their positions relative to the Aberdare Seam, with any of the Bundamba seams.

* A tunnel was sebsequently driven on this seam. The coal proved to be of inferior quality.

To the east and south-east of the colliery workings there is possibly a large field of coal but because of fires and creeps it will be out of the question to attempt to re-open the pit. In order to reach the coal beyond the workings it will be necessary either to sink a vertical shaft or to employ some other method involving a heavy outlay on dead work and also to provide a second opening for ventilation. In view of the existence of an extensive washed-out area in the southern part of the colliery preliminary diamond drilling should form an essential part of any plan to work the coal beyond the existing workings.

Bryant's Shaft. — Mr. L. C. Ball (1924) reporting on prospecting operations in portion 144, Purga, stated that W. Bryant and partner claimed to have located 12 ft. of clean coal underlain by 11 ft. of coal with a few bands in a hand bore. Subsequently a shaft was sunk on this block of land to a reported depth of 200 ft. There are conflicting reports about the nature and attitude of the strata passed through but it seems to be agreed that the Aberdare Seam was not met with, though fragments of what I believe to be Aberdare Conglomerate are present in the spoil dump.

Ipswich No. 4 *Bore.*—This was the fourth bore put down by the Government diamond drilling plant in the present campaign. It is located at the corner of Short and Lion Streets to the west of the Golf Links in R.863, parish of Ipswich. The basalt which crops out nearby was found to be 120 ft. thick. It was succeeded by Tertiary clays and shales the latter showing occasional impressions of dicotyledonous plants. It had not reached the coal measures when last visited by me.

Ipswich No. 2 *Bore.*—This hole was drilled one chain from Blackstone Road almost opposite Lusitania Street. Tertiary shales and clays (including a little low-grade oil shale) occurred to a depth of 120 ft. and were succeeded by basalt (with interbedded magnesian limestone in the upper part) to a depth of 770 ft. Below the basalt there were Tertiary clays and shales to the bottom (913 ft.).

It was estimated that the Aberdare Seam, if it were not eroded, should be found not more than 700 ft. from the surface. The occurrence of Tertiary beds more than 200 ft. below that point is taken to indicate that the Aberdare Seam has been eroded from this locality though, because of our present ignorance as to the course of the seam east of Queen's Park, the possibility of the seam lying at a greater depth cannot be altogether excluded.

Ipswich No. 3 *Bore.*—This hole was drilled to a depth of 256 ft. in portion 8, Ipswich (about midway between Booval and East Ipswich). The coal measures here lie at a depth of 120 ft., being overlain by Tertiary clays and sandy alluvium. Sandstone (much of it very coarse) predominated from 120 ft. to 188 ft. and from 188 ft. to 256 ft. the strata were chiefly shale and coal. The section from 188 ft. to 216 ft. comprised alternating bands of carbonaceous shale, coal, and "bluey." Average dip was about 30 degrees.

The fuel ratio of the coal, as revealed by a proximate analysis of a twelve-inch section at 190 ft., coupled with the presence of calcium carbonate in some of the beds, suggests that the section lies in the Cooneana Stage.

CHAPTER 12.

BUNDAMBA TO BLACKSTONE.

Browne and Macdonald's Bore.—In 1910 Drs. Browne and Macdonald financed the drilling of a borehole in portion 157, Goodna (near Bundamba Railway Station). Cameron (1912) reported that the bore had reached a depth of 1,100 ft. without striking a workable seam. The record of the bore shows that the basalt which outcrops here is only 40 ft. thick. It is succeeded by some 400 ft. of Tertiary clays, shales, and sandstones, and then follows a section 460 ft. thick of shale, sandy shale, and thin sandstone beds. Thin beds of limestone and "lime streaks" are reported between 700 and 750 ft. A seam of coal 3 ft. thick is reported at 489 ft., and coal veins and streaks are fairly frequent between 578 ft. and 706 ft. From 920 ft. to 1,089 ft. the record shows coarse sandstone and conglomerate. At this point the bore entered basalt or dolerite, in which formation the hole bottomed.

In the report referred to Cameron expressed the opinion that the seam at 489 ft. was the Little West Moreton, and he correlated the coarse sandstone and conglomerate with the Aberdare Conglomerate. The strike of the Aberdare Seam as previously shown by Cameron (1907) swings towards the west in levels going north from Coolgardie Shaft, and the seam, if projected from Ferrett's level in that colliery to the position of the bore, would be over 600 ft. above the surface. I am of the opinion that the coarse sandstone and conglomerate passed through from 920 ft. to 1,089 ft. belongs to the Cooneana Stage. I estimate that the Braeside No. 1 Seam should have been met with at a depth of 630 ft. or thereabouts but only coal veins are recorded. Actually all the Braeside seams, as well as two of the overlying seams, should have been passed through; one can only surmise that they die out in this direction. The basalt or dolerite on which the bore bottomed is no doubt a sill and is probably on a similar horizon to the basalt sills reported in Rylance Nos. 2 and 3 Bores in portion 254, Goodna (see p. 94).

Wallsend (or Walsen) and Speedwell Tunnels (abandoned).—I was unable to locate these old tunnels which are supposed to have been driven on Braeside No. 1 Seam in portions 141 and 149 respectively. The latter is said to have run into a washout (Tertiary beds) at a distance of six chains from the mouth. The two pits are situated on the nose of a north-westerly pitching anticline on the extreme northerly exposure of the Bundamba Anticline.

Braeside Colliery (abandoned).—The *Braeside Colliery* property lies on and immediately west of the axis of the Bundamba Anticline. The pit was opened about the year 1884 by Lindsay Brothers. No. 1 Shaft in portion 159, Goodna which is 270 ft. deep, intersected seams at 15, 90, 130, and 270 ft. Cameron (1899) records that the three uppermost seams were worked over a considerable area and that they all furnished good coal between 3 and 4 ft. in thickness. No. 2 Shaft, situated 12 chains to the west-south-west, is reported to have met Braeside No. 1 Seam at 90 ft., but it is not known if this is the total depth of the shaft. There is an old tunnel driven on to No. 1 Seam through the overlying shales two chains west of No. 1 Shaft.

No. 3 Shaft, which is not mentioned by Cameron, is reported to have met No. 2 Seam at a depth of 25 ft. and No. 3 Seam at 104 ft. There is also a tunnel (No. 2 Tunnel) four chains west of No. 3 Shaft on No. 1 Seam. This tunnel, which is still open, shows a seam of coal 4 ft. thick. Though rather banded the coal itself is of good quality.

In portion 245 there is an old tunnel, no longer accessible, stated by Cameron to be on No. 2 ("Striped Bacon") Seam. Though I have not been able to view the seam I am of opinion that this is No. 3 Seam, and I have mapped it as such.

The pit seems to have closed down early in the century. No. 3 Shaft was subsequently re-opened under the name of **Enterprise Colliery,** to be abandoned again about 1912. In 1913 the proprietors of *Rhondda Colliery* purchased the property renaming it **Rhondda No. 3.** No. 3 Seam was worked to the dip from No. 3 (*Enterprise*) Shaft, the worked section being, according to Mr. D. W. Cochrane (Director), 2 ft. 10 in. thick. Operations ceased in 1922, since when the pit has remained closed.

No. 1 Seam is believed to have been worked down to the unconformable junction with the overyling Tertiaries. No. 2 Seam was probably not extensively worked. No. 3 Seam was probably the most extensively worked of all the seams, but the limits of the workings, except about No. 3 Shaft, are not known. Nothing is known as to the extent of the workings on No. 4 Seam.

The prospects of this property are difficult to assess. It is likely that a good deal of coal remains unworked but the seams are thin and apparently rather banded, and are thus not likely to attract capital to work them.

Day Dawn Colliery (abandoned).—This property adjoins *Braeside Colliery* to the east. It lies astride the Bundamba Anticline, the strike swinging round from north-south in the western part to east-west in the east. The coal dips to the north at angles ranging from 5 degrees or less to 15 degrees over the greater part of the area. There are a number of tunnels on Braeside No. 3 Seam, while Nos. 2 and 4 Seams have been worked to a small extent.

The original owners of the land, Messrs. Scarborough, worked the coal in a small way from tunnels on the outcrop. Scarborough's workings

Lindsay's Hard Seam truncated by the Braeside Fault. The light colour of the weathered shale on the right is in marked contrast with the crop of Lindsay's Hard Seam (left). Locality: Bergin's Hill, Bundamba.

[*Photo.—A. M. McKenzie.*

were abandoned by 1900. In 1915 one of the tunnels, known as "**Blackball**", was reopened and worked for a brief period. In 1930 New Ebbw Vale Coal Company opened a tunnel on No. 2 Seam but abandoned it a year later in favour of *"Blackball" Tunnel,* which in the meantime, seems to have been worked in a small way by Millar and party under the name of "**Eskbank Colliery**". The pit, which was re-named **New Ebbwvale No. 2** was then worked until 1935, when the Company took up the Woodend property.

There are four tunnels on No. 3 Seam, only one of which (generally known as *"Blackball"*) is still open. This shows a seam just under 4 ft. in thickness. The top band of coal, which is 12 in. thick, is of inferior quality and has not been worked in this pit. The worked section is 2 ft. 8 in. to 2 ft. 10 in. thick, and includes two thin stone bands. The plan shows the workings to be continuous with the Enterprise workings on the same seam, and it is reported that there is a connection with the western levels from Stafford's old tunnel in portion 256. A tunnel in portion 245, shown on Mr. Cameron's 1923 map to be driven westerly on No. 2 ("Striped Bacon") Seam is believed to be on No. 3 Seam.

There is an old tunnel on No. 4 ("Lindsay's Hard") Seam in portion 246. A fault (the Braeside Fault), which is visible at the entrance, plainly indicates the downthrow to be to the north, but the amount of downthrow cannot be estimated. The tunnel is driven on to the seam through the superincumbent strata and shows 12 ft. of coal and stone bands overlying the worked section very little of which, unfortunately, is now visible. The seam is overlain by some forty feet of coarse pebbly sandstone ("Cooneana Sandstone") and then shale to No. 3 Seam. An unknown thickness of sandstone underlies No. 4 Seam.

No. 2 Seam is visible in an old tunnel **(New Ebbw Vale No. 1)** in the northern part of portion 246. The worked section is 3 ft. 11 in. thick, including three bands of shale of an aggregate thickness of 5½ in. The coal is rather inferior and the workings are not extensive. The outcrop of the seam is exposed in a shale quarry near *"Blackball"* Tunnel.

There is no prospect of any future large-scale production in this property. No. 3 Seam is practically worked out whilst No. 2 Seam is hardly workable. Little is known of No. 4 Seam beyond that in the adjacent property it was small and hard though reportedly of good quality.

Aberdare No. 6 Colliery and adjacent Tunnels.— The property comprises the Bundamba Racecourse Reserve and portions 160 and 161, Goodna. In the early days of the field the lower seams had been worked in portion 161 by Bergin, but the Four Foot Seam had not been traced north of portion 162 where it was dislocated by a fault. In 1941 Aberdare Collieries Pty Ltd. located the Four Foot Seam under a thin mantle of alluvium in portion 121 and drove a tunnel on it across Bundamba Creek into the Racecourse. Recently an old tunnel on the Bergin's Seam in portion 161 has been cleaned out and enlarged for the purpose of installing an endless haulage. A stone drift is to be put through to the Four Foot Seam and all haulage will be done through the new tunnel, which is known as *Aberdare No.* 8.

The Four Foot Seam here has a working section varying from 4 ft. 1 in. to 4 ft. 9 in. (average 4 ft. 5 in.). The "brushing band" over the double white stone is 20 in. thick, but it is inferior in quality and is not worked. A lenticular ironstone band ("boulder") is generally found 2 ft. 6 in. above the pavement. The quality of the coal in the worked section is not as good as in the Dinmore district.

The average dip of the seam is about 10 degrees. At the outcrop the strike is 20 degrees west of north but going down the dip it gradually swings to the west and at the bottom level, some 25 chains from the outcrop, it is 60 degrees west of north.

The southern levels met a fault striking 75 degrees east of north. This is the Coronation Fault but it is to be noted that its strike (east-north-east–west-south-west) diverges widely from that assumed by Cameron (north-west and south-east). At the outcrop of the Four Foot Seam the Coronation Fault has a downthrow to the north of approximately 120 ft. Two minor faults have been met with in the lower levels on the north side of the dip.

Aberdare No. 8 Tunnel is down 7½ chains. It has the appearance of having been hurriedly abandoned (perhaps on account of flooding), for old mining tools were found still lying at the dip face. The workings are not extensive. The section previously worked was 2 ft. 6 in. thick; but the present company proposes to take out an additional 2 ft. 6 in. to 2 ft. 7 in. of the underlying coal. This 5 ft. section includes six stone bands aggregating 8 in. Under the above section there are reported to be two feet of coal and stone bands and then three feet (some say seven feet) of coal.

Towards the dip face a transgressive stone band or "runner" occurs. This rises up from the pavement and, gradually thinning out, reaches half-way up the seam where it joins a permanent stone band, and eventually disappears. It has the appearance of having been thrust up in the form of mud from underneath during the formation of the seam, perhaps due to an earth tremor.

In addition to the Four Foot and Bergin's Seams three lower seams, perhaps Braeside Nos. 2, 3, and 4, have been opened up south of the Coronation Fault. The old tunnels have long ago collapsed and there are no exposures of any of the seams on which they were driven.

In assessing the prospects of this property two unknown factors have to be taken into account. One is the thickness and quality of the lower seams, the

other is the extent to which the Four Foot Seam, and possibly the Bergin's Seam, may have been eroded. With regard to the first doubt the seams were all worked to some extent and it seems reasonable to suppose that they will be workable under present-day not very exacting market conditions. As regards the possible washout of the upper seams, it is known that the northern levels from the *Borehole Tunnel,* all on the Aberdare Seam, came up against a "clay want" or washout; and it is known from the records of the Stafford Street Bore that both the Aberdare and Bluff Seams have been removed by pre-Tertiary erosion, the surface of the coal measures lying beneath a thickness of 389 ft. of Tertiary clay and basalt. Prior to the driving of *Aberdare No. 6 Tunnel* it was generally believed that the Four Foot Seam was completely eroded under the Bundamba Racecourse. The workings, however, have already gone 15 chains into the racecourse without meeting any washout; and as the coal is getting deeper the further they advance there is reason to hope that the seam will be found to underlie the greater part of the reserve. The chances of the Bergin's Seam being eroded are still slighter.

If it can be assumed that there has been no erosion of the coal and that all the seams are workable and do not deteriorate to the dip there will be some two-and-a-half million tons of coal on the property. In the Four Foot and Bergin's Seams alone possible reserves are estimated at over one million tons.

United No. 1 Colliery.—The property, which was Stafford's original colliery known as "**Rosehill**", embraces portions 162, 163, and part of 164, Goodna. At least four seams were worked by tunnels driven from the outcrops. Stafford Brothers abandoned the property about the year 1890 in favour of the much superior New Chum Seam at Dinmore which they had been working for some years. There is no record of any further activity between then and 1909, when the Rosehill Colliery Company opened a tunnel on the Bergin's Seam. This venture does not seem to have been successful. In 1911 the Coronation Coal Company acquired portion 162 and the Racecourse Reserve. They drove a new tunnel through old workings on the Four Foot Seam in portion 162 but struck the Coronation Fault. A tunnel was then driven on the Bergin's Seam which was considered unworkable, and operations were suspended. These two tunnels were known collectively as **Coronation Colliery.** Portions 162, 163, and subdivision 2 of portion 164 were taken up by United Collieries Pty. Ltd. in 1938. A tunnel was driven through old workings on the Four Foot Seam but abandoned soon after because there was insufficient coal in the pillars which they had proposed to extract.

A tunnel was then driven on a seam in the north-eastern corner of portion 163, but as they ran into troubled ground on the northern side of the tunnel a new tunnel was driven towards the southern boundary of the block, and this is the present working tunnel. The seam lies 230 ft. under the Rob Roy Seam and is tentatively correlated with Braeside No. 4 Seam. Like the latter, it is overlain by a succession of stone and coal bands and then coarse sandstone. Braeside No. 4 Seam lies 250 ft. under Braeside No. 1 Seam which, as has already been stated, may be identical with the Rob Roy Seam.

The average dip of the coal is 20 degrees. The direction of dip is about 10 degrees south of west, except in the southern part of the mine where it swings to almost south-west. On the ridge which overlooks Bundamba Creek in the western part of the property dips range from 22 degrees to 50 degrees in a direction 10 degrees north of west. There is no swing toward the south-west corresponding with the swing of the seam in the workings. This is considered to be due to the rapid increase in the thickness of the sandstone lens overlying the seam in United No. 1 Tunnel going south.

The seam has not been traced into portion 162 but, notwithstanding the faulted ground reported immediately north of the old tunnel, it is considered that the seam cannot have been displaced to any great extent, as there is no appreciable dislocation of the upper seams on the line of supposed faulting. The troubled ground is believed to be due to the sharp bending of the strata as indicated by an abrupt change in the strike immediately north of the tunnel. If this is so, the seam opened up near the south-western corner of portion 242 (originally called Dobbie's Seam) is probably identical with the seam being worked in *United No. 1 Colliery.*

The worked section of the seam is about 3 ft. 3 in. thick in the dip but it increases going south to 3 ft. 9 in. There are two lenticular stone bands 2 to 3 in. apart near the roof and an inconstant "bluey" band about 2 in. thick 14 in. from the floor. The coal is bright and hard and in places is inclined to be nodular. Overlying the seam 1 measured 9 ft. 9 in. of coal and stone bands, and the manager reports a further 7 ft. of similar beds above this section. An attempt was recently made to work a section of coal 8 to 10 ft. above the main seam. It was over six feet thick but included two thick stone bands and the coal was rather inferior. The two coals were mixed but the ash content so increased that the exploitation of the top section had to be discontinued.

A striking feature of this pit is the presence of a number of transgressive stone bands or "runners." They cut obliquely across the seam from floor to roof and run roughly at right angles to the strike of the seam. They are composed on the upper side of white, sometimes laminated, clay peppered with tiny aggregations of iron carbonate and on the under side of argillaceous massive iron carbonate. Small flakes of coal are sometimes found lying parallel with the laminae. The coal is usually, but not always, slightly indurated for one-half to one inch from the contact. The thickness of the "runners" ranges from a few inches to a couple of feet. They actually go down into the shale floor of the seam but it is not known if they persist right through to the

sandstone roof. Only two of the "runners" were encountered south of the (new) tunnel, but according to the manager they were so numerous in the northern workings as seriously to interfere with the working of the seam.

The origin of these "runners" is something of a puzzle. At first sight they resemble igneous dykes, but for a number of reasons I consider such an origin has to be ruled out. Firstly, they maintain a strikingly uniform thickness and possess straight walls, whereas the undoubted igneous dykes observed elsewhere cutting through coal seams are irregular as to thickness, and have uneven walls. Secondly, the coal in contact with the "runners" is not coked, the induration, as revealed by microscopic examination, being due to ferration. Thirdly, neither lamination nor visible iron carbonate which are characteristic features of the "runners" was noted in any igneous dyke, and fourthly, coal in small flakes could hardly be expected to survive as such after being caught up in molten lava.

They have obviously been thrust into the seam, but whether from above or from below is not known. It appears, too, that "coalification" must have been fairly well advanced at the time of their formation, for otherwise the soft argillaceous material would have mingled with the coal and spread along the seam. They differ in many respects from any of the "wash-outs" or stone dykes described in the literature, particularly in their straight walls and fine texture. The uniformity of strike suggests that the "runners" were deposited in fissures resulting from a uniform movement, perhaps due to slumping of the coal, following a slight local upwarping.

A good example of contemporary faulting was observed in this pit. The stone bands near the roof are broken by repeated faulting, the movement being of the order of 2 to 4 inches, while the leathery parting forming the roof is not affected. This condition is no doubt due to slumping of the unconsolidated vegetable matter brought about perhaps by earth tremors.

Some relatively minor faulting was encountered in the southern workings. One apparently large fault striking north-west and south-east has been met with at decreasing distances from the tunnel in the southern levels. The downthrow appears to be to the south-west, though this is not definitely established. The throw of this fault may not be as great as the disturbance of the strata about it would suggest, for there is no appreciable dislocation of the upper seams along the projected line of the fault.

So far as this particular seam is concerned possible reserves within the property are reckoned at 120,000 tons. As regards the upper seams no estimation of reserves is possible. The Four Foot Seam for all practical purposes appears to be worked out. The Bergin's Seam which varies in thickness from 4 ft. to over 6 ft. appears to have been worked to only a small extent. Its future working probably depends on the degree to which it can be beneficiated by washing. The Striped Bacon and Rob Roy Seams are not visible. They have both been worked, but to what extent is not known.

In portion 162 there is an old tunnel, known as **Molloy's**, on a seam which is considered to lie about 50 ft. above the seam at present being worked. It is 6 ft. 6 in. thick but it carries eleven stone bands, one of which is 16 inches thick. The top section 3 ft. 3 in. thick has been worked to a limited extent.

In a shaft sunk in the north-eastern corner of portion 163 the manager reports that three seams were intersected. The first, which was 3 ft. thick, was found 7 ft. from the surface; the second (thickness 3 ft. 2 in.) at 38 ft.; and the third (thickness 2 ft. 10 in.) at 56 ft. These three seams are probably lower than any of the worked seams in the Bundamba district. Like many of the other seams occurring in the Cooneana Stage they are rather small for working though the coal is of moderately good quality.

While there is no dearth of coal seams on the property the reserves of workable coal do not appear to be large. There may still be moderate reserves in the Striped Bacon and Rob Roy Seams but as nothing is at present known as to the thickness and quality of these seams or the extent of the workings on them, this cannot be counted on.

The Stafford Street Bore.—A description of the strata passed through in this bore which was put down by the "Southern Coal Syndicate," and is situated in the south-eastern corner of portion 148, Ipswich (near the Bundamba Racecourse) has been given in a report by W. E. Cameron (1913A). He records that the bore first passed through 70 ft. of basalt and then 323 ft. of Tertiary strata, reaching the coal measures at a depth of 389 ft. A seam of coal was passed through from 509 ft. to 513 ft. and a second seam lay between 579 ft. and 604 ft. "These two seams," he says, "correspond perfectly in section and position with the Four Foot and Bergin's Seams."

The nearest outcrop of these two seams to the Stafford Street Bore is in portion 162. Assuming an average dip of 1 in 5 the Four Foot and Bergin's Seams should be respectively 630 ft. and 700 ft. deep at the site of the Stafford Street Bore. As there seems little doubt that the seams met with were the Four Foot and Bergin's it follows that there must be a considerable flattening of the dip between the outcrop and the borehole. It is also apparent that the Coronation Fault (if it persists) must lie to the north of the bore.

Borehole Colliery (abandoned).—The *Borehole Colliery* property was an irregularly-shaped piece of ground embracing the Bundamba Racecourse, portions 149, 150, Ipswich, and portions 174, 173, Goodna. The history of the Borehole Company is not very well known. The Aberdare Seam was opened up by a tunnel in portion 174 and apparently quickly worked out between the narrow limits set by the

washout to the north (already alluded to) and the western and southern boundaries of portion 174. A shaft was sunk (also in portion 174) ahead of the crop of the Aberdare Seam. It intersected the Aberdare Seam at 104 ft., the Bluff Seam at 224 ft., and the Four Foot Seam at 520 ft. A level was driven 15 chains north on the Four Foot Seam and the coal was subsequently worked to some extent. The Four Foot Seam was also worked by a tunnel driven on the outcrop. The old plans show that the Striped Bacon and Rob Roy Seams were also worked. The latest record of mining in the property is that, in 1904, 7,000 tons of coal were produced.

The mine plan shows the north levels from the tunnel on the Aberdare Seam terminating against a "clay want" at an average distance of 3½ chains from the tunnel. No. 2 Borehole put down in the south-west corner of portion 150, Ipswich, by the Borehole Company, according to the record quoted by A. G. Maitland (1896) intersected a 10 ft. seam of coal at a depth of 232 ft., approximately the depth at which the Aberdare Seam was to be expected. If the record is reliable there must be an isolated area of Aberdare coal of unknown area about the borehole. This could easily be tested by putting down a series of diamond drillholes in the vicinity.

So far as the Four Foot Seam is concerned there is probably a good deal of coal still intact, but the deterioration of the seam in depth (as happened in the nearby "*Ladysmith*" *Tunnel*) is to be expected.

The Bergin's Seam is unworkable in portion 164, where recently opened up by H. Price, and in "*Lady-Smith*" *Tunnel* and hence in all probability in portions 173 and 174.

An old tunnel on the Striped Bacon Seam in William Street, Blackstone, has been recently cleaned out and an examination (very hurried because of the presence of black damp) showed that the working section was 3 ft. 7½ in., including 4½ in. of stone in four bands. The coal appeared to be of good quality. In the absence of any record as to the extent of the workings no estimate of reserves is possible.

Nothing is known of the Rob Roy Seam in this property, except that it was six feet thick and that it was worked to a limited extent.

CHAPTER 13.
BLACKSTONE TO PALMER'S ESTATE.

Aberdare Colliery (abandoned).—The *Aberdare Colliery*, opened by L. Thomas about 1870, is the best known and one of the oldest collieries in the Blackstone district. The Aberdare property was extensive, comprising portions 158, 159, Ipswich (where the Coolgardie workings are situated), 175, 176, 270, 300, 286, 181, 182, 183, Goodna, and the whole of Blackstone Village. For many years the seam was worked by "daylight" tunnels (*i.e.*, tunnels where the waggons are wheeled from the working faces to the pithead without recourse to mechanical haulage) in portion 270. The flat-dipping seam was exposed in a deep gorge ahead of the main outcrop, offering an ideal situation for economical working of the coal. Later, when all available coal was taken by this method, three vertical shafts were sunk. No. 3 Shaft, also known as *Coolgardie Shaft*, was worked for some time by the employees on a co-operative basis.

The property changed hands about 1910. The Queensland Cardiff Coal Company purchased the northern part and Messrs. Walker Brothers (Aberdare Collieries Pty. Ltd.) the southern portion.

The Cardiff Company worked pillars in the old Aberdare workings and at the same time sank a shaft in what is known as Blackleg Gully (where Thomas had his "daylight" tunnels) to a depth of 685 ft. In 1915 a bore was put down alongside the *Cardiff Shaft* to a depth of 1,500 ft. In the meantime a tunnel was driven on the Four Foot Seam in Section IIIA, Blackstone (see under "*United No.* 2"). The Company ceased operations in 1917 following an explosion in the shaft workings.

Mr. W. Binnie, who had been associated with the *Aberdare* and *Cardiff Collieries* for many years, in 1922 opened up a tunnel in Blackstone Village which he called "**Old Aberdare**" **Colliery,** and worked the coal lying between the outcrop and the old *Aberdare* and *Borehole* workings. These workings were abandoned in 1931.

In 1927 the Aberdare Consolidated Company, another of Mr. Binnie's ventures, reopened the old Aberdare No. 1 Shaft in portion 175. The Consolidated workings became merged with the **Hart's Aberdare** workings, which consisted of a number of tunnels driven either from the outcrop or through the overlying strata on to the Aberdare Seam. *Hart's Aberdare Colliery* has worked Aberdare "tops" and bottom pillars under great disadvantages, but, nevertheless, they managed to carry on for some fifteen years until eventually compelled to close down in 1945 by the spread of underground fires.

From 1937 to 1941 in **Rylance Aberdare Tunnel** a small area of coal underlying the late L. Thomas's residence on Blackstone Hill was worked. There was very little cover over the seam and the coal was all more or less affected by weathering. The coal caught fire and the ground has collapsed, ruining beyond repair the once beautiful grounds surrounding the residence.

Messrs. Walker Brothers sank a shaft near the southern boundary of portion 286 to work the coal lying south of the Aberdare Fault which the previous proprietor had never succeeded in penetrating. This shaft was later (1922) sunk to the Bluff Seam, which proved to be 148 ft. vertically below the Aberdare Seam. The lower seam was reported to be 42 ft. thick but, except for the bottom nine feet, it consisted chiefly of "bluey" and stone bands. Two tunnels were driven through the steeply dipping Aberdare Conglomerate on the south side of the Aberdare Fault and through the fault itself to work the "New Found Out" Seam which is reported to have varied from 3 ft. 6 in. to 13 ft. in thickness and to have been separated from the main Aberdare Seam by as much as 80 ft. of strata. South of the fault the "New Found Out" section was no more than 14 ft. above the main Aberdare Seam. To the north-west the "New Found Out" Seam cut out on a conglomerate roof. A third tunnel was driven on the outcrop of the seam to work a small faulted block of coal near the western boundary of portion 286. The last work done was the removal in 1926 of the large pillar of coal left about the shaft.

The "*Round Shaft*" workings in portion 183 will be dealt with under the heading of "*Aberdare Extended No.* 2 *Colliery*" (see p. 74).

I was fortunate enough to view the full section of the Aberdare Seam in *Hart's Aberdare* Nos. 4 and 5 tunnels just prior to the closure of the colliery. The measured thickness of the seam was 13 ft. 3½ in. The "tops" were 6 ft. 1½ in. with three stone bands aggregating seven inches. The "bottoms," separated from the "tops" by twelve inches of coal and stone (top "badger"), were 6 ft. 2 in. thick including the bottom "badger" ten inches thick 1 ft. 6 in. from the roof. The seam dipped to the west at an angle of one in five. According to old miners this may be taken as a fair average of the coal worked in the Aberdare property except in the southern part where the seam is split by a considerable thickness of stone.

In the northern part of the property there do not appear to have been any major dislocations. Further south, however, the strata are folded into an open anticlinal arch pitching south-south-west. This fold appears to fill out going north-north-east, for there is no sign of it at the outcrop of the seam. There is some faulting associated with this fold, the main fault lying parallel with but some five chains north-west of the anticlinal axis.

The Aberdare Fault has already been described (see p. 19). On the map accompanying his second report Cameron (1907) shows the Aberdare Fault as a dyke though in the text it is described as a

fault. There are a number of minor faults associated with the Aberdare Fault which must have considerably hampered the working of the coal in its vicinity.

The Aberdare Seam may be regarded as completely worked out in portions 270, 286, and 300. There seems to be a small unworked area (about seven acres) in Water Reserve R.378 (parish of Goodna), and a comparatively large area bounded by the West Moreton Fault to the south-west, the old erosion surface to the north-west, and the West Moreton and Coolgardie workings on the east and north-east. As the mine plans of *Coolgardie Colliery* are not quite up-to-date the exact area of coal here is in doubt but it is considered to be not less than 110 acres. The area is almost wholly included in portions 178, 179, Goodna, and portions 143, 157, 160, 161, Ipswich. The plan does not show any faults or dykes in the Coolgardie workings. The swing of the strike in the northern levels has already been mentioned.

The West Aberdare (Grange) Bore (portion 143, Ipswich).—The Grange Bore, completed in 1915, intersected a seam of coal between 1,331 ft. and 1,360 ft. The depth of the Aberdare Seam here, as calculated from the Coolgardie workings, should be about 1,350 ft. Thus the identity of the seam intersected in the borehole with the Aberdare appears beyond doubt. The existence of the seam at this depth shows that the bore has been put down on the north-eastern or upthrow side of the West Moreton Fault (if it persists that far).

The section of Tertiary rocks passed through correlates reasonably well with that proved by Ipswich No. 2 Bore, except for the bands of magnesian limestone. The upper ("Silkstone") shales and mudstones were passed through from the surface to 150 ft. (120 ft. in Ipswich No. 2 Bore). The bore then passed through 23 ft. of magnesian limestone, whereas Ipswich No. 2 Bore penetrated 84 ft. of decomposed vesicular basalt and interbedded green earths, before entering the first magnesian limestone. The second bed of magnesian limestone, which was 51 ft. thick, was separated from the first bed by 44 ft. of vesicular basalt. There followed 18 ft. of decomposed basalt and then 52 ft. of what Cameron (1916) describes as marly clays. The bore was in basalt from 483 ft. to 819 ft. (base of basalt in Ipswich No. 2 Bore occurred at 770 ft.) and in shales, mudstones and soft sandstones from 819 ft. to 955 ft. (770 ft. to 913+ ft. in Ipswich No. 2 Bore).

The Grange Bore appears to have been commenced at a slightly higher horizon in the upper shales and mudstones than Ipswich No. 2 Bore. The indications are that the beds of magnesian limestone are lenticular in character and are restricted to the upper half of the basalt.

Cardiff Shaft and Bore.—The Cardiff Shaft was commenced from a position just under the Aberdare Seam and was sunk to a depth of 547 ft. without encountering a workable seam. A bore was then put down near the shaft and drilled to a depth of 1,500 ft. In this section only one coal seam of workable thickness was reported. This was passed through between 660 ft. and 665 ft. 3 in. The shaft was then deepened and, according to a report by Mines Inspector W. E. Lawrie (1916), the seam was reached at a depth of 685 ft. The section of the seam, as measured by Mr. Lawrie at the face of the east* level, was as follows:—

	ft.	in.
Roof	Hard Shale.	
Coal	0	9
Band	0	0½
Coal	0	4½
Band	0	1
Coal	2	0
Floating Penny Band		
Coal	0	9
Band	0	0½
Coal	1	10
Band	0	1
Coal	0	10
Band	0	1½
Coal	0	8
Total ..	7	7

The coal was stated by Mr. Lawrie to be of "very promising quality." The seam was worked to a small extent, but following a gas explosion in 1917 the workings were abandoned.

A remarkable feature of the Cardiff Bore was the absence of the lower seams. The Bluff Seam, which is some 30 ft. thick in the neighbouring *Borehole* and *West Moreton* Collieries, consisted of a section of shale with coal streaks four feet thick at 189 ft. In the place of the Four Foot Seam there were three feet of shale with coal streaks. Below this the section becomes difficult to correlate. Twenty-three feet under the Four Foot Seam there were four feet of shale and coal streaks that could be the horizon of the Bergin's Seam. At 442 ft. (70 ft. below the Four Foot horizon) they passed through three feet of coal and stone bands including one foot of good coal. At 521 ft. there were ten feet of shale with coal bands and at 590 ft., five feet of shale with coal bands. From 634 ft. 6 in. to 645 ft. the bore passed through shale with coal bands up to fifteen inches thick. This was separated from the 7 ft. 7 in. seam by 15 ft. of shale. Cameron correlated the 7 ft. 7 in. seam with Lindsay's Hard Seam (i.e., the seam underlying the Rob Roy Seam). On the section quoted, however, it cannot be correlated with any of the known seams. The horizon appears to be about that of Braeside No. 2 Seam. Underlying the 7 ft. 7 in. seam there were about 100 ft. of sandstone with thin interbedded shales. There followed 240 ft. of shale with one or two

* Probably should read "south."

thin sandstone bands, and from there to the bottom of the bore shale and coarse sandstone. Thin coal seams were passed through at 1,073 ft., 1,320 ft., and 1,354 ft. The last 110 ft. were in coarse conglomeratic sandstone with four thin shale beds. In a report on the bore Cameron (1916) stated—"It is very probable that the bore, in its lower portions, has passed through a series of strata representing those carrying the half-dozen seams worked at North Ipswich. If so, these seams have thinned out to such an extent as to have become valueless under this portion, at least of the Bundamba area. The failure of this bore in proving any coals of value for over 800 ft. below Lindsay's Hard Seam does not augur well for the occurrence in workable condition of the North Ipswich coking seams under the Bundamba area."

As has already been shown, the Cooneana Stage underlying the Rhondda Shales is some 800 ft. thick; from which it follows that the Cardiff Bore was just entering the Tivoli Stage and possibly had not reached the horizon of the Garden Seam.

United No. 2 Colliery (abandoned).—Generally known as "**Ladysmith**" this tunnel, which is on the Foot Four Seam, was driven by the Cardiff Company. Subsequent to its abandonment by that company it was re-opened in 1927 by a party of miners and recently it passed into the hands of United Collieries Pty. Ltd. It is now completely worked out. I inspected the colliery immediately prior to its abandonment.

The Four Foot Seam in this colliery had a working section of 3 ft. 11 in. The top twenty inches of coal are of very good quality but the next eighteen inches are rather inferior. The bottom six inches is good coal. Overlying the two white stone bands in the roof there are eighteen inches of inferior coal and then some twenty feet of shale with coal bands. The Four Foot Sandstone outcrops very prominently in the property but it is not more than thirty feet thick.

It is reported that the seam in the face of the dip consists of black shale with only streaks of coal. That the deterioration is not merely local is borne out by the evidence of the *Cardiff Shaft*, 14 chains beyond the face, where the seam was represented by shale with coal streaks.

Mr. H. Price, one of the proprietors, told me that he sank a shaft in the dip about 180 yards from the entrance to test the Bergin's Seam. At 63 ft. a ten-inch seam of coal was intersected. A borehole was put down another 18 ft. in shale. It would appear that the ten-inch coal band is the local, much attenuated, representative of the Bergin's Seam.

Fairbank Colliery (abandoned).—The Fairbank Tunnel in portion 295, Goodna, was driven by Walker Brothers in the early years of the century. As the Aberdare Seam underlaid only the south-western corner of the property (which also included portion 294) it was not long before the coal was worked out, and the pit was abandoned in 1913. The Four Foot Seam was also worked to a small extent from a tunnel in portion 295. The Aberdare Seam strikes north-north-west–south-south-east and is reported to dip rather more steeply than usual. The only faulting shown on the plan occurs at the extreme north of the workings where the seam is dislocated by one of the spur faults lying to the south of the Aberdare Fault. Only the bottom section of the seam was worked over most of the area but a small area of top coal seems to have been exploited from a separate tunnel just north of the main tunnel.

Aberdare No. 4 Colliery (abandoned).—Aberdare No. 4 Tunnel, or "**Aspro**" as it is generally called, was driven on the Four Foot Seam in portion 296, Goodna, by Messrs. Aberdare Collieries Pty. Ltd. in 1925. The workings extend through portion 195 and terminate just inside portion 194. The greater part of the coal was worked by the longwall method. The colliery embraces the old *Fairbank* workings on this seam. The pit was abandoned in 1934.

Between the "*Ladysmith*" workings and the *Aberdare No.* 4 workings the eighteen-inch section of inferior coal near the bottom of the seam shows a marked deterioration and was not worked in the latter colliery. The top section, which increased in thickness to 2 ft. 2 in., alone was worked.

The "brushing" band above the two white bands begins to improve in this colliery, and it is considered that with beneficiation it should meet present-day market requirements.

The Bergin's and Striped Bacon Seams are reported to have been prospected by vertical shafts in portion 295, but owing to a thick secondary growth of vegetation I could not locate the shafts. The former is reported by Cameron (1907) to be 4 ft. 2½ in. thick including 3½ in. of stone in four bands.

West Moreton Colliery (abandoned).—The old *West Moreton* property lay to the west (*i.e.*, to the dip) of the *Aberdare Colliery*, and in order to reach the Aberdare Seam they had to sink a vertical shaft 630 ft. deep. The seam was worked down to a large fault (the West Moreton Fault), beyond which no coal was found notwithstanding the driving of a stone drift 400 ft. long. The seam, thus restricted, did not take long to work out, and the workings were abandoned prior to 1900. The shaft was continued to a depth of 928 ft., bands of coal and shale, representing the Bluff Seam, being passed through between 814 ft. and 844 ft. The strata below the Aberdare Seam were shales, sandy shales, and thin sandstone beds. Unfortunately the shaft was not continued far enough to test the Four Foot Seam.

The shaft had passed through two feet of good quality coal at a depth of 160 ft. On the exhaustion of the Aberdare coal this seam, which is known as

the Little West Moreton, was worked to some extent both from the shaft and from a tunnel driven from the outcrop of the seam. I was able, at some hazard, to descend the tunnel for a short distance and measure the section of the seam, which was slightly weathered at this point. The seam itself was just two feet thick and included one or two lenticular penny bands. In the roof there were six inches of "bluey," succeeded by eighteen inches of low-grade canneloid coal, a sample of which, on destructive distillation, yielded oil at the rate of 14 gallons per ton. The canneloid coal is succeeded by eight inches of fine-grained, banded sandstone, and then by massive coarse sandstone.

The dip of the strata in this property is 20 degrees to 25 degrees to the west. The plan shows a dyke one-half to three-quarters of a chain in width running north and south through both sets of workings. This dyke is said to be present also in the Aberdare workings.

The colliery was inspected in 1894 by Rands who concluded that the Aberdare Seam was thrown up on the south-western side of the West Moreton Fault. (See Annual Report of the Geological Survey for 1894, p. 26). Recent work in *Aberdare Extended No.* 1 *Colliery* has shown that the seam there is thrown down to the south-west on the West Moreton Fault by some 300 ft.

A shaft was sunk in portion 228, Ipswich, to work the seam beyond the fault. A. Gibb Maitland (1896) concluded that the shaft was being sunk in a large igneous dyke, and it was abandoned when it had reached a depth of 80 ft. Actually the "dyke" was a bed of outcropping magnesian limestone, and there is no doubt that had the shaft been continued it would have intersected the Aberdare Seam; but allowing for a downthrow of 300 ft. on the West Moreton Fault, they would have had to sink some 1,450 ft. to reach it.

Aberdare Extended No. 2 Colliery (abandoned).—Aberdare Extended No. 2 Shaft (generally referred to as the "**Round Shaft**") is situated in portion 183, Goodna. It was commenced by the original Aberdare Company as No. 4 Shaft but abandoned when it had reached a depth of 80 ft. It was later continued by Aberdare Collieries Pty. Ltd. (Walker Brothers) and in 1918 reached the bottom section of the Aberdare Seam at a depth of 303 ft. The bottom section of the seam was separated from the top section by a wedge of shale the thickness of which in the shaft was 19 ft. In the south-eastern part of the colliery a third section, the "New Found Out," lying some distance above the "tops" was worked. The "New Found Out" was missing altogether from the shaft section but is reported to have grown rapidly to a thickness of 6 ft. going south-east. It persisted into the adjacent Box Flat property, where it was worked to a considerable extent.

The workings were limited by old workings on the north and west, by the West Moreton Fault on the south, and by the *Box Flat* boundary on the west. The colliery closed down about 1934 when all available coal had been worked out.

The frayed ends of the Aberdare Fault caused a great deal of trouble in the western part of the colliery. The coal was reported to be steeply tilted near the *Box Flat* boundary.

Aberdare Extended No. 1 Colliery.—The main shaft, which is situated in portion 221, Ipswich, was commenced in 1910, and reached the Aberdare Seam in the following year at a depth of 665 ft.

In the workings to the rise (now inaccessible) the "tops" and "bottoms" were separated by a wedge of shale and sandstone which increased in thickness going south and east. The plan of the rise workings shows a sharp anticlinal fold (which I propose to call the "Swanbank Anticline"), and what is termed a "clay fault." The latter (actually a decomposed igneous dyke) may be followed on the plans from the Extended Fault southwards through *Aberdare Extended No.* 1 workings and *New Aberdare* workings for a distance of 70 chains in a perfectly straight line. The Swanbank Anticline fills out and disappears approaching the main shaft. The recovery of coal from the rise workings was fairly satisfactory, about half the pillars being extracted.

The dip workings are remarkably free from faults or other troubles and yet only a relatively small proportion of the coal has been recovered. Constantly recurring creeps with the resultant firing of the seam caused section after section of the pit to be sealed off. Only the bottom section of the seam has been worked, and it is estimated that considerably less than ten per cent. of the coal has been recovered. Pillars were being extracted from the "North Dip" workings at the time of inspection.

The worked section of the Aberdare Seam in the "North Dip" workings, which alone are still accessible, is 6 ft. 3 in. to 6 ft. 9 in. thick. It includes the "badger" (8 in. thick) and a lenticular ironstone band as well as one or two inconstant "bluey" bands one to two inches thick.

To the north the workings terminate against the Extended (or Mafeking) Fault over a length of nearly 1½ miles. This is a normal fault with downthrow to the north at the level of the shaft bottom of 260 ft. In 1935 a stone drive was started from near the shaft bottom in order to work the coal on the northern side of the Extended Fault. Good progress was made until they met the fault where the ground was so bad that it could not be held by ordinary means, and a thick concrete envelope had to be constructed around the drive. They had been unfortunate enough to meet the Extended Fault near its intersection with a strike fault. It was not until 1942 that mining of coal in this section was commenced.

It is plain that the Extended Fault must grow going west, for the average dip of the seam north

of the fault is 25 degrees or more compared with 15 degrees in the "North Dip" workings.

The seam worked in the stone drive section, though undoubtedly occurring on the horizon of the Aberdare Seam, has quite a different section to the latter. It is separated from the Aberdare Conglomerate by 17 ft. of stone and coal bands and is between 8 and 9 ft. in thickness. It carries no permanent stone bands but there are generally three or four lenticular brown stone bands up to one inch thick. It has been suggested that this is the "New Found Out" Seam. This does not seem unlikely as the latter was worked only fifteen chains away in the *"Round" Shaft* workings; but if it is, then it must be separated from the Aberdare Seam by a much greater thickness of strata than usual. The stone drive has penetrated the strata underlying the seam to a perpendicular depth of 90 ft. without intersecting any coal, whereas I understand the "New Found Out" was usually no more than 30 ft. above the Aberdare Seam.

Minute faults and slickensides are numerous in the Stone Drive workings, and great difficulty has been experienced in holding the roof. They tried limiting the working height to six feet using a stone band about 2 ft. 6 in. from the top of the seam for a roof, but this has been only partially successful as the stone band is lenticular and may disappear altogether in places.

For practical purposes all coal south of the Extended Fault may be regarded as worked out. Possible reserves north of the fault are large; but conditions there are such that a high extraction of coal cannot be counted on, and unless some more suitable working method can be devised it will be difficult to mine the seam much below about 1,500 ft. It is of the utmost importance to establish whether the normal section of the Aberdare Seam is present under the seam now being worked in the Stone Drive section. If it should be present it is likely that it would have a good stone roof and so be workable to considerable depths. There are prospects of limited reserves to the rise of the bottom of the Stone Drive but in this direction the Extended and West Moreton Faults, between which the coal lies, are rapidly converging, and the ground, besides getting narrow, is likely to be very disturbed. It is this narrow trough between the converging faults that separates *Aberdare Extended No.* 2 from *Aberdare Extended No.* 1 *Colliery.* The downthrow on the West Moreton Fault here is estimated to be of the order of 300 ft.

Two diamond drillholes put down to test the seam on the northern side of the fault in portion 224 and 225 respectively encountered rather different sections of Tertiary rocks. No. 1 (in portion 224) passed through 35 ft. of clay, then 36 ft. of basalt, and finally 192 ft. of "conglomerate and sand" before entering the coal measures. In No. 2 bore there were 255 ft. of basalt under 52 ft. of clay and then 63 ft. of clay. It is evident that the basalt thins out rapidly as the southern edge of the Tertiary Basin is approached.

The Little West Moreton Seam is reported to have been passed through in the shaft (Depth ?) and it was passed through in No. 2 diamond drillhole between 860 ft. and 862 ft., though not in No. 1. The Four Foot Seam will be about 1,000 ft. deep at the shaft. It could be reached by driving through the Extended Fault from the Stone Drive workings. There is little inducement to test the lower seams which are not of sufficiently good quality or of sufficient thickness in this district to start mining them at more than 1,000 ft. from the surface.

Box Flat Colliery (abandoned).—The *Box Flat Colliery* was opened by McQueen and Company about the turn of the century. Coal-mining was continuous until 1935, when fires caused the abandonment of the pit. The property includes portions 298, 299, 184, 185, 186, Goodna. The original tunnel was started on the outcrop of the Aberdare Seam near the eastern boundary of portion 298. Subsequently a vertical shaft was sunk 405 ft. to the seam, and through it most of the coal was drawn to the surface. Later tunnels were driven respectively at the northern, eastern, and western boundaries of the property for convenience in working pillars. The last work done on the property (in 1930) was the driving of a stone tunnel in portion 298 to work the coal in the north-eastern corner of portion 16, Bundamba, which had recently been acquired by the company. Only a small area of coal was available on the northern side of the Mafeking (= Extended) Fault; but, even so, they were forced to abandon the workings on account of the extremely heavy water coming from the old workings above, before all the coal was worked out.

The Aberdare Seam cannot now be viewed in the *Box Flat* property. Both sections of the seam were worked except in the lowest workings where the "tops" were split off from the "bottoms" by a wedge of shale and sandstone, as in the "Round Shaft" workings. In the western part of the mine the "New Found Out" Seam was worked fairly extensively. This seam ranged from 4 ft. 6 in. to 6 ft. in thickness. It lay about six feet below the Aberdare Conglomerate and about 30 ft. above the Aberdare Seam. The plan shows the Aberdare Seam to be folded into two synclines separated by an open anticline. The western syncline is rather a sharp fold, particularly in the northern workings where it abuts against the Aberdare Fault. The folds fill out to the rise and are not apparent at the outcrop of the Aberdare Seam.

The Bluff Seam has recently been prospected by a vertical shaft, started a few feet below the Aberdare Seam, in the north-eastern corner of portion 298. Mr. R. McQueen, for whom the shaft was sunk, reports that the seam was met with at a depth of 100 ft., being overlain by blue shale. For eleven feet there were bands of coal and shale; then followed three feet of "bluey"; and below that 5 ft. 11 in.

of coal with four stone bands aggregating four inches. The coal was considered too inferior to work. The lower seams have not been prospected in Box Flat property.

A good deal of pillar coal was lost, due to creeps and subsequent firing of the coal when pillar-robbing commenced. In reporting the abandonment of the colliery the Mines Inspector, Mr. T. Sharp (A.R.D.M. for 1935, p. 181) states—"By the abandonment of *Box Flat Colliery* a fairly large area of Aberdare seam has been left in, and it is doubtful if this coal will ever be recovered as the workings now contain a large body of water which would be fairly costly to remove."

Bogside Colliery (abandoned).—This colliery, which lies to the south of Box Flat, was started about the beginning of the present century. The Aberdare Seam underlay only about 35 acres of the property and was quickly worked out.

The Aberdare Conglomerate here forms a prominent hill with escarpments facing south and east. The hill is practically devoid of vegetation owing to the escape of the fumes of underground fires from innumerable cracks. It is remarkable that the fires have kept burning for so many years in the coaly shales overlying the seam.

A tunnel **(Bogside No. 2)** was driven on the Bluff Seam in portion 297, but the coal was not extensively worked. H. G. Noble Limited later purchased the property and worked the pit as **Noblevale No. 5.** It was finally abandoned in 1930. The Bluff Seam in this tunnel has a minimum thickness of 17 ft. 6 in., of which only the bottom five feet appear to be workable.

Mafeking Colliery (abandoned).—The *Mafeking Tunnel* on the Aberdare Seam was driven by the New Swanbank Company about 1900. The workings were confined to a narrow strip of country in the north of portions 17 and 18, Bundamba. In the north and west the coal was worked out to the boundary of the property but the southern levels all ran into a large fault, the Mafeking (= Extended) Fault, at distances varying from nine chains near the crop to two chains in the bottom of the dip. Cameron (1907) records that in a level 200 yards down the dip the fault brought up the Bluff Seam into juxtaposition with the Aberdare Seam, thus indicating a downthrow to the north of approximately 100 ft.

Box Flat Extended Collieries.—The property to which the proprietors, Box Flat Colliery Company, have given the general title of Box Flat Extended Collieries includes a number of old pits as well as large areas of coal lands (either leased or as freehold) outside the old colliery properties. The old collieries embraced in the property are *Noblevale No.* 3 (now known as *Box Flat Extended No.* 4), *Swanbank, Denham, Parkhead.* The last-named colliery included part of the Perkins Freehold, the balance now being held by the estate of the late Mr. A. Wright.

The original **Swanbank Colliery,** comprising portions 13, 14, 17, Bundamba, and 207, 212, 213, and 214, Ipswich, was opened up about 1890. The Aberdare Seam was worked (by a shaft and a tunnel) until they struck a dyke, which was believed to be a large fault, and the mine was abandoned. The property was purchased by the New Swanbank Company about 1898 and the **Denham Tunnel** was driven in portion 13, through the overlying Aberdare Conglomerate, to work pillars in the upper part of the *Swanbank* workings. The date of closure of these pits is not known but it is on record that the *Denham Tunnel* was re-opened in 1914 and *Swanbank* in the following year. These revivals were probably short-lived, as there is no record of any activity in either colliery since that time. **Parkhead Colliery** was started in 1910 by the proprietors of the *Box Flat Colliery.* The first tunnel was driven on the Bluff Seam. In 1922 a tunnel, now known as *Box Flat Extended No.* 2, was driven on the Aberdare Seam in portion 11. In recent years a new tunnel, known as *Box Flat Extended No.* 5, has been driven on the Bluff Seam. **Noblevale No. 3** worked both top and bottom sections of the Aberdare Seam by a vertical shaft. To the dip the workings came up against the dyke which caused the closure of the *Swanbank Colliery* (it is marked "Swanbank Fault" on Cameron's 1923 map). The coal was taken out as far as possible down to the dyke and the colliery was abandoned in 1922. The shaft was unwatered in 1937 by McQueen and Company and the dip was continued through the dyke which proved to be no more than two feet thick and did not appreciably displace the seam. This colliery, which is known as **Box Flat Extended No. 4,** is still in operation.

Throughout the explored part of Box Flat Extended property the top section of the Aberdare Seam is separated from the bottom section by 50 to 60 ft. of sandstone and shale, and the exploitation of the two sections has been carried out independently. Towards the southern part of the property the coaly measures above the top section thin out and in places disappear together with the upper part of the seam.

The bottom section of the Aberdare Seam in No. 4 pit and in the northern part of No. 2 is between 6 ft. and 7 ft. 6 in. thick, the "badger" being from 9 in. to 2 ft. thick. Going south the "badger" grows and the coal below it becomes progressively thinner and poorer. Mr. McQueen reports that in the air shaft in No. 2 Colliery the "badger" had become a sandstone bed 50 ft. thick, the middle section of coal being 2 ft. thick and of good quality. Beyond some prospecting tunnels there are no workings on the Aberdare "bottoms" south of portion 11, Bundamba.

In *Box Flat Extended No.* 4 (late *Noblevale No.* 3) *Colliery* both "tops" and "bottoms" of the Aberdare Seam have been exploited, the vertical distance between the two seams in the shaft being 60 ft. Only the bottom seam is now being worked.

The anticlinal structure, already noted as occurring in the south-eastern corner of *Aberdare Extended No. 1 Colliery* and which I have named the "Swanbank Anticline," lies almost immediately south-west of the shaft. The axis here runs approximately south-east and north-west. On the north-eastern limb the dips are steep, and thrust faulting on a small scale is prevalent. From the shaft bottom, where the seam is about horizontal, to the crest of the anticline, there is a rise of 80 ft. On the south-western limb of the structure the dips are normal, *i.e.*, 10 to 15 degrees. As mining is now restricted to the area beyond the axis of the structure, the coal has to be hauled to the crest of the anticline and from there lowered to the shaft bottom.

An interesting and puzzling feature of No. 4 Colliery is the occurrence of a band of ironstone ("boulder") in the seam 9 to 10 in. below the "badger." This "boulder" is found only to the rise of the dyke, suggesting that iron-bearing solutions percolated along a more or less permeable band in the coal subsequent to the tilting of the strata and the intrusion of the dyke, which prevented the further penetration of the solutions. If this hypothesis be correct, either the deposition of the ironstone must have preceded the folding of the seam or the ferrated waters must have entered the seam along the somewhat shattered crest of the anticline, for the "boulder" is found on both limbs of the structure.

The plans show a fault striking north 60 degrees west running within two chains of the shaft. One of two stone drives put through the "fault" is still accessible for a couple of chains. Investigation showed the "fault" to be the line of termination of a sill which rapidly widens and eventually completely replaces the seam. In this case the lava is presumed to have come up on the Mafeking fault fissure and to have spread along the seam for a short distance. A small basalt knob, which lies astride the road between portions 16 and 17, is considered to be a bulge in one of the dykes rather than an outflow of lava.

A stone "runner," three to four inches thick and similar in its mode of occurrence to that in *Aberdare No. 8 Tunnel,* is to be seen in the main dip. It rises at a very acute angle from the pavement and traverses the seam until it reaches the "badger," with which it eventually merges. Mr. Connah examined the rock microscopically and found it to be a fine-grained sediment containing carbonaceous fragments. It may have been thrust into the seam from below during the time when the "badger" was being deposited.

Box Flat Extended No. 2 Tunnel is driven on the steeply-dipping (30 degrees) outcrop of the lower portion of the Aberdare "bottoms." The working section in the old *Parkhead Colliery* varied from two to three feet, the irregularity in thickness being due to a "rolling" sandstone roof. The seam was rather extensively worked for a distance of 12 chains down the dip, but below that the quality of the coal deteriorated, and very little of it was taken out. Subsequently a level was driven north-west below the lowest workings of the old Swanbank Company. This level became the haulage road from a dip driven west near the northern boundary of the colliery and from here all the workable coal between *New Aberdare* and *Swanbank* workings is being recovered. The reserves of coal in this section are uncertain. New Aberdare worked the seam as far as the south-eastern corner of portion 208, Ipswich, though the coal was reported to be inferior in this direction. Again, in the bottom of *Box Flat No. 2 Tunnel* the seam is unworkable and it is considered that it would be unsafe to count on any reserves in portion 207. Actually development in the colliery is nearing an end, but the extraction of pillars will take a number of years to complete.

So far as I can learn, the Aberdare "tops" have not been worked in portions 207, 212, and 213. The seam is reported to deteriorate going south-west from the old *Denham* workings. In New Aberdare it was of inferior quality and only worked to a very small extent. There are two tunnels known collectively as **Box Flat Extended No. 3 Colliery** on the "tops" in portion 5, Bundamba. At the outcrop the seam was seven feet thick and, though somewhat banded, was of good marketable quality. Down dip, however, the stone bands increased in number and thickness so much that 150 yards from the outcrop the seam was unworkable. Faulting also added to the difficulties and the tunnels were abandoned after working only five years.

With the approaching exhaustion of the Aberdare coal the Bluff Seam is beginning to loom important as the future mainstay of the *Box Flat Extended* properties. In this part of the field the Bluff Seam reaches its acme as regards both quality and thickness.

In *Box Flat Extended No. 4 Colliery* the Bluff Seam was reached by a stone drive near the shaft bottom. This drive is not accessible but the manager, Mr. H. Brown, reports that the seam was excessively banded and did not show a workable section. The seam, however, where tested was badly faulted and, in consequence, probably somewhat deteriorated. It is suggested that a further trial in a less disturbed place might show an improved section.

The old *Parkhead Tunnel* (No. 1) on the Bluff Seam in portion 11 is now closed. *Box Flat Extended No. 5* Tunnel is driven on the outcrop of the seam four chains south-east of No. 2 Tunnel. Like the latter it goes down at an angle of 30 degrees but it quickly flattens out, the inclination at the face of the dip being no more than 12 degrees. The top coal only is being worked but it was possible to view the whole section of the seam. From roof to pavement the seam is 32 ft. thick. It carries two workable sections, the top one immediately under the roof being 4 ft. 9 in. to 6 ft. 3 in. thick and the bottom section, immediately overlying the pavement,

5 ft. thick. Between these two sections the seam is excessively banded, though a section, 5 ft. 5 in. thick and separated from the bottom section by eight inches of "bluey," carries no more than six inches of stone in four bands.

The top section carries three permanent stone bands aggregating five to eight inches. In the southern workings the coal bands are thinner and of relatively inferior quality compared with the northern workings. One or two minor faults have been met with but they have not seriously interfered with mining operations. Exclusive of stone bands the coal carries about 20 per cent. ash.

The bottom section is five feet thick in the one accessible exposure. It carries two one-inch stone bands. The present intention is to leave it intact until the top section is worked out.

A new tunnel is now being driven near No. 5. It is to be provided with a double roadway and equipped with an endless haulage in anticipation of handling 400 tons a day, which is more than double the present output. Reserves in the two sections of the Bluff Seam to a depth of 1,500 ft. in the *Box Flat Extended* property are estimated as follows: probable reserves 5 million tons; possible reserves 2½ million tons.

The lower seams in the *Box Flat Extended* property are not promising. Three seams were passed through in a Government diamond drillhole (Ipswich No. 1 Bore), in portion 5 which was drilled in 1943. These were respectively 170 ft., 340 ft., and 405 ft. below the Bluff Seam. The uppermost of these, though at a considerably greater depth below the Bluff Seam, is tentatively correlated with an unnamed seam lying 100 ft. below the Bluff Seam in *Southern Cross Collieries*. A grab sample of coal from a shaft on this seam and representing a thickness of approximately 6 ft. had an ash content of 29·4 per cent. The next seam in the borehole was 3 ft. 4 in. thick, without any major stone bands. The third seam was 18 ft. thick and was made up of alternating bands of inferior coal and stone. For the last 140 ft. the bore was in coarse sandstone and grit. None of the coal sections intersected by this bore resembles the Four Foot Seam. It is desirable that the hole should be deepened in the hope of establishing a correlation of the section here with the known succession elsewhere on the field.

The Howard Smith Bores. In 1908 Messrs. Howard Smith Limited put down three bores in their Lagoon property comprising 503 acres about Ivory's (or Swanbank) Lagoon which they had purchased early in the year. It might be mentioned here that the positions of the bores as shown on a plan supplied by the company are at variance with the positions indicated on Mr. Cameron's 1923 map. In the map accompanying the present report the positions of the bores are amended to agree with the Howard Smith plan. In each of the bores a thick seam was passed through, which was considered to be the Aberdare Seam. For a number of reasons which are stated below it is now concluded that the seam in question was the Bluff, and not the Aberdare. A drive put out toward No. 1 Bore from Box Flat Extended No. 2 Tunnel failed to intersect the bore but went within thirty yards of it. As projected from the end of the drive the seam should intersect the borehole at a depth below the surface of 480 ft., whereas the seam reported by the driller was intersected at a depth of 575 ft. Furthermore, the Aberdare Seam is in two, if not three, widely separated sections the biggest of which is no more than two feet thick while the seam in the bore was reported by the driller to be twenty feet thick. Again, the bore record shows the seam to lie under 95 ft. of shale, whereas practically the whole of the strata between the Aberdare "tops" and "bottoms" consists of sandstone; and finally, the Aberdare Conglomerate comes almost down to the top section of the Aberdare Seam.

No. 2 Bore intersected a seam with an apparent thickness of 38 ft. and underlying 96 ft. of shale, while in No. 3 Bore a seam 21 ft. thick was intersected underlying 73 ft. of shale. Apart from "bituminous shale" or thin coal bands about the horizon of the Little West Moreton Seam no other seams were reported in any of the bores. The probable explanation of the failure of the driller to report the Aberdare Seam is that (1) the "tops" and "bottoms" were in every case widely separated; and (2) both sections were thin and of poor quality, or perhaps even non-existent.

The Howard Smith bores merely confirm the evidence of the various mine workings in the vicinity that the Aberdare Seam rapidly becomes unworkable going south and west from the *Box Flat Extended Collieries*. There is, of course, a possibility that the seam may improve again further west. This could be tested by putting down a bore in the vicinity of portion 348, Ipswich, where it is expected the horizon of the Aberdare Seam would be not more than 1,000 ft. below the surface.

New Aberdare Colliery (abandoned).—This property lies south of *Aberdare Extended No.* 1 and to the dip of the *Box Flat Extended Collieries*. The main shaft was commenced in 1913 and the Aberdare Seam (bottom section) was reached in 1916 at a depth of 836 ft. The shaft was continued to the Bluff Seam, which was met at 961 ft. Messrs. Walker Brothers (Aberdare Collieries Pty. Ltd.) acquired a controlling interest in the property in 1919. The mine worked continuously on the Aberdare Seam until its abandonment in 1941. In 1939 work was commenced on the top coal which lay about 60 ft. above the bottom section, but the quality of the coal was poor and with the exhaustion of the bottom seam the pit was closed down.

In the northern workings the seam was similar in section to that worked in the neighbouring *Aberdare Extended Colliery* and they had the same difficulties to contend with, the result being a small percentage recovery of the coal. With the splitting

of the seam in the central and southern parts of the pit they had a very much better roof and by the extensive use of longwall mining the greater part of the coal was recovered. In the fifty acres or so where longwall mining was employed the extraction of coal was one hundred per cent.

The splitting of the bottom section of the seam appears to have taken place in the southern part of the pit just as it did in *Box Flat Extended No.* 2 to the east. Beyond the split the seam was only two or three feet thick and the quality deteriorated; this seems to have been the chief factor leading to the closure of the colliery.

The decomposed dyke, already mentioned in the section dealing with *Aberdare Extended No.* 2 *Colliery*, is shown on the plan traversing the workings from south to north. Mr. J. Conway, Superintendent of Aberdare Collieries Pty. Ltd., states that the dyke is associated with a fault which throws the seam down to the west by some fourteen feet.

Southern Cross Collieries.—In 1928 the late Mr. A. Wright, having finally abandoned his North Ipswich collieries, began to prospect the country between the Mafeking Fault and the *Denham Tunnel* workings. He located three isolated areas of faulted Aberdare coal, but these were small and quickly worked out. Perhaps the most interesting of Wright's discoveries was that the summit of Mafeking Hill was underlain at a shallow depth by the Aberdare Seam, which here was as much as 18 ft. thick. As a result of the removal of this coal the entire summit has subsided and will probably continue to subside as additional areas of coaly measures are burned away.

In 1936 Mr. Wright opened a tunnel (**Southern Cross No. 4**) on the Aberdare "tops" in portion 13, Bundamba. East of Bundamba Creek the workings were not extensive, being limited on the north by old workings from *Noblevale No.* 3 and by *Swanbank* workings to the south; but after driving through the dyke ("Swanbank Fault") into portion 214, Ipswich, they were in virgin ground. The area from which Mr. Wright was at liberty to remove the coal was relatively small, and by 1944 the colliery was abandoned.

No. 6 Colliery was driven in 1938 on the top section of the Bluff Seam.

The early tunnels on the Aberdare Seam have collapsed and the seam is no longer visible. The plans show a number of faults striking approximately west-north-west–east-south-east. One of them, stated by Mr. Wright to have thrown the seam down 50 ft. to the north-north-east, is visible at the entrance to No. 3 Tunnel. The faulting is responsible for the isolated nature of the workings. A good deal of coal was left behind in No. 3 workings, which had to be abandoned on account of fires.

The average thickness of the Aberdare "tops" in *Southern Cross No.* 4 *Colliery* was 3 ft. 9 in. It carried two permanent stone (or "bluey") bands and usually one or more lenticular stone bands. The pavement stone was a band of shale two to six inches thick, and underneath it was a band of coal four to six inches thick which was worked when the intervening stone band was small. In the dip the dyke was three feet in width but seven or eight chains to the north-west it was reported to be as much as 24 ft. through. The tunnel was driven on to the coal through the overlying strata (conglomerate, sandstone, and shale) at the crest of the Swanbank Anticline.

Southern Cross No. 6 Tunnel goes down on the steeply dipping (30 degrees) outcrop of the top section of the Bluff Seam. The tunnel lies in the disturbed country about the axis of the Swanbank Anticline, and it is not surprising to find that a number of faults have been met with in the workings. The largest of the faults is a multiple thrust fault seen in the main dip 280 yards from the entrance. The seam hereabouts is contorted to an extraordinary degree but the actual displacement is small, probably not exceeding 10 ft., the upthrow being to the west. Beyond the fault toward the dip face part of the banded middle section of the seam is exposed. It includes one possibly workable section five feet three inches thick including five inches of stone in five bands. The line of thrust faulting extends in a south-south-easterly direction and has been met at increasing distances from the tunnel in this direction. A second system of thrust faults has been encountered in levels on the northern side of the dip. This line of faulting strikes north-west and south-east, and the upthrow is four to five feet to the north-east. No coal has been worked north-east of the fault.

As the dip seemed likely to continue in troubled country a cross dip was started on a bearing 267 degrees about 10½ chains from the tunnel entrance. This will take them away from the main area of disturbed country and will no doubt result in a greater output and lower costs.

The section of coal worked in No. 6 Colliery is 5 ft. 3 in. thick. It includes two constant stone bands as well as a number of lenticular bands. Usually there is a band of "bluey" eighteen inches from the roof, and actually in the early stages only the section below this band was mined. The coal is rather hard by comparison with the other coals of the field.

The bottom section of the seam as exposed in a tunnel near No. 6 Tunnel is 4 ft. 5⅓ in. thick including 7½ in. of stone in five bands. Though the quality of the coal is quite fair (sample showed 17·7 per cent. ash compared with an average of 21 per cent. for the top section), the stone bands are rather excessive for a seam of this size.

Southern Cross No. 7 Tunnel was being opened at the time of my visit to the field. It starts in portion 12 but is designed to work the coal lying in portion 18, which is cut off from that in No. 6

Tunnel by faulting. It is expected that a moderately large tonnage of coal will be won in this pit, though operations are bound to be hampered by faults.

Only one seam lower than the Bluff has been located in the Southern Cross property. This lies about 100 ft. below the Bluff Seam. There is an old tunnel on it near No. 6 Tunnel which shows a section 3 ft. 2 in. thick including 2½ in. of stone in four bands. The coal is inclined to be "duffy" and, unless it improved in quality, would not be marketable. There are at least two feet of coal and stone bands overlying this section and a further unknown thickness of bands under the pavement. What is believed to be the same seam has been prospected by three short tunnels some ten chains to the north-east. Because of the presence of two white stone bands at the top of a three foot section of coal Mr. Wright considered the seam in the latter place to be the Four Foot Seam. The two bands, however, seem to be inconstant as they were not seen in the tunnel near No. 6 pit.

The Aberdare Seam may be regarded as virtually exhausted in the Southern Cross property, though it may still be possible to work one or two isolated blocks. The Bluff Seam, in addition to the section now being worked, has two other possibly workable sections. In portions 13, 14, 17 reserves in the top section alone are estimated to be half-a-million tons.

Thistle No. 4 Colliery.—In 1937 a sub-lease of parts of portions 12 and 13, Bundamba, was secured by a small working party and a number of tunnels driven into the outcrop of the Aberdare Seam along the boundary between these two portions. A small output was obtained by working the pillars in the old *Swanbank* workings, but they eventually had to be abandoned because of fires. At present they are working the top section of the Bluff Seam between the crop and the boundary. The seam dips at 25 degrees to 30 degrees to the west-south-west. The thrust fault running through the southern levels in Southern Cross No. 6 Colliery was passed through in the tunnel. It threw up the seam six feet to the south-west. The worked section is 4 ft. 6 in. to 6 ft. thick, increasing towards Oaky Creek. The area of coal available is no more than five to six acres, and even at the current small rate of output (16 tons a day) the coal will soon be worked out. The bottom section of the Bluff Seam has still to be tested.

Portions 131, 132, 133, 134, *Bundamba.*—A good deal of prospecting work has been done in these blocks, including shaft-sinking and tunnelling, all apparently without worthwhile result.

In portion 131 two tunnels have been driven on a seam dipping at five degrees to the north, and in one of them the coal appears to have been worked to a small extent. The seam was not visible but a 12 in. section of shaly canneloid coal overlying it was sampled and found to yield crude oil at the rate of six gallons per ton. This seam is estimated to lie about 120 ft. below the Bergin's Seam and is believed to be the Striped Bacon Seam, the large lens of sandstone under the former being responsible for the abnormal interval between the two seams.

A lower seam is exposed in a shaft 25 ft. deep some three chains south of one of the tunnels. From the surface a seam of coal, estimated to be six feet thick, is visible at the bottom of the shaft. No major stone bands can be seen but it is clear from the material lying about the shaft that the seam carries a number of minor stone bands. Some of the coal is of good quality. This seam lies approximately 65 ft. below the ?Striped Bacon Seam, and may be the Rob Roy.

There is an old shaft about four chains from the western boundary of portion 132, shown on Cameron's 1907 map as being 106 ft. deep. The 1923 map has a noting—"No sign of Coal" opposite the shaft. Perhaps the shaft has been deepened in recent years as there is now some coal lying on the dump.

An old shaft 54 ft. deep in the south-western corner of portion 133 must, to judge by the material in the dump, have been sunk almost entirely in sandstone. The last material brought up was inferior coal and coaly shale, but there does not appear to have been a workable seam.

A diamond drillhole put down near the south-eastern corner of portion 133 is reported by the driller, Mr. J. Berry, to have reached a depth of 350 ft. The upper part of the hole was in shale and the lower part chiefly in coarse sandstone. A seam of inferior coal was passed through about 320 ft. from the surface.

A number of other old prospecting shafts and potholes are scattered over these portions; but results so far as coal discoveries are concerned seem to have been negative.

The crest of the southern dome on the Bundamba Anticline lies in this area and the greater part of the outcropping shales and sandstones belong to the Cooneana Stage. What seams there are appear to be small and of poor quality.

Eureka Tunnel (abandoned).—There is no official record of this old tunnel. It is shown on Cameron's 1907 map but there is no description of it in the text. The tunnel commences in Water Reserve R.391 (parish of Bundamba) near the Bonnie Dundee Siding and is driven on a bearing of 125 degrees into portion 147. Though it has been abandoned for some forty years it is still possible to creep into the tunnel and examine the seam. The worked section where measured was 4 ft. 10½ in. thick and included four stone bands with an aggregate thickness of 5½ in. In the roof there are nine feet of shale and coal bands and then coarse sandstone. The seam dips to the east-south-east at an angle of 8 degrees, and thus lies on the eastern limb of the Bundamba Anticline. The identity of the

seam is uncertain. From its position it appears to be low down in the Rhondda Shales or perhaps even in the Cooneana Stage.

As exposed near the mouth of the tunnel the seam is of workable quality and thickness. It is understood that the workings are not extensive, so that there may be a useful field of coal here.

Ideal Colliery (abandoned).—The Ideal Colliery Company was formed in 1927 to work the coal in an old tunnel in portion 149 and to open up a tunnel on a newly discovered seam in portion 94. Two years later the company went into liquidation.

It was just possible to crawl into the tunnel in portion 149. Unfortunately the full section of the seam was not visible, but above the mud the following section was measured:—

	ft.	in.
Shale Roof		
Coal	0	4
Black Shale	0	2
Coal	0	8½
"Badger"	0	8
Coal	0	4
Stone	0	0½
Coal	0	1½
Ironstone	0	1
Coal	0	10
Stone	0	1½
Coal	1	0
Total	4	5 +

The seam is rather excessively banded but the coal for the greater part appears to be of good quality. It is likely that the seam will be worked again at some future time.

The Ideal Company also drove a tunnel on to a seam in portion 94 but it was not worked. This has been re-opened in recent years (see below under "*United No. 5 Colliery*").

The identity of the seam in portion 149 is doubtful. It dips to the south at 17 degrees where measured in the tunnel, and thus lies on the axis of the Bundamba Anticline. It may be the Striped Bacon Seam, though it cannot be much more than 500 ft. below the Aberdare Seam. It appears to be on a higher horizon than the seam in the Eureka Tunnel.

Mr. Cameron's 1923 map shows two tunnels in the north-west corner of portion 101, one of which is called Harris' Tunnel. I was unable to locate any old tunnels in this place but I was informed that what is usually known as Harris' Tunnel is in portion 94, and is driven on the Bluff Seam.

United No. 5 Colliery (usually called "**Ideal**").—The old tunnel which had been started in portion 94 by the Ideal Company in 1928 was re-opened by United Collieries Pty. Limited in 1940 and is being worked by a tribute party. The seam, which is between six and seven feet thick, includes three permanent stone bands and a number of lenticular bands. In the upper levels there is a "badger" about 18 in. from the floor, which in the lowest workings is represented by a stone band half-an-inch thick. The coal is of moderately good quality, but the ash content is increased by the unavoidable inclusion of thin stone bands. In the air shaft there are reported to be 11 ft. of coal and stone bands over the worked section, and then massive sandstone.

The pit is situated in a badly faulted area. For the first two chains the tunnel, which is driven on to the seam through the overlying strata, is in steeply dipping and, in places, brecciated sandstone. Then after passing through a fault hading north-east the tunnel enters the seam which dips south-easterly at one in five. The north-west levels swing fairly sharply to the west and eventually come up against a fault striking at 330 degrees. This fault has been pierced by a stone drive for a distance of 15 ft. but the face is still in highly disturbed strata (shale and coal mixed). The tunnel met this same fault 10 chains down and the face is now in sandstone. The fault, which here is clear-cut, is seen to hade north-east at an angle of 45 degrees. A bore put down from the surface 50 yards ahead of the dip face intersected a seam of coal at a depth of 100 ft., which is approximately the depth of the dip face. Assuming that the seam in the borehole is the seam on which they have been working, the fault is estimated to throw the seam up 25 ft. to the south-west. It is expected that a basaltic dyke which crops out at the surface will have to be cut through before the tunnel reaches the coal. Yet another fault is reported in the south-east workings, but this could not be examined.

The seam in the borehole is 100 ft. below the Bluff Seam, so that if, as seems likely, it is identical with the seam in *United No. 5 Tunnel*, the latter should be the unnamed seam already reported as occurring in *Southern Cross* and *Box Flat Extended Collieries*.

Once the tunnel has been driven beyond the fault no major disturbance is anticipated in that particular direction (south-west) and a moderately large area of coal should be available for exploitation.

United No. 5 Extended Tunnel has been driven on the Bluff Seam from a position only thirty yards from Harris' old tunnel. It is connected with the pithead at *United No. 5* by a light tramway. They are working a section at the bottom of the seam. In the old tunnel the coal was worked to a height of only three feet, but in the new pit it is proposed to work a section over six feet thick including nine inches or more of stone. Steady production has not yet commenced at the pit. The top section of the Bluff Seam has yet to be tested here.

Southern Cross No. 2 ("Green Gully") Colliery (abandoned).—After considerable prospecting, including diamond drilling, in portions 94, 95, and

97, Bundamba, the late Mr. A. Wright in 1935 drove a tunnel near the south-western corner of portion 94. Though disappointing from an economic viewpoint, this tunnel is nevertheless extremely interesting geologically. It was commenced in a dark grey shale of rather curious aspect which outcropped where the top section of the Aberdare Seam should have been. This shale shows no tendency to cleave parallel with the bedding, which is very ill-defined. It has a sub-conchoidal fracture but in the mass tends to break along a defined "cleat" like coal. It has a greasy, brownish streak. Under the lens it is seen to be made up of exceedingly fine streaky mud with numerous particles of coal and a number of more or less rounded sub-translucent bodies of mineral origin. Here and there the shale includes patches up to 12 in. across of soft coal, some of which, after removal of the coal, show the external cast of part of a tree trunk. This shale is quite distinct from the roof stone, which is an ordinary shale and continuous with the shale overlying the seam. The tunnel was driven 50 yards in shale before the first wedge of coal was seen in the floor. This gradually widened until the dip was wholly in coal. The line of contact of the shale and coal, though uneven, is sharply defined. At this stage in the driving of the tunnel it looked as though a big field of coal was ahead, but, unfortunately, stone "runners" began to make their appearance. At first they were small and infrequent but as the tunnel advanced the "runners" increased in number and thickness and, to make matters worse, the shale roof was replaced by sandstone and conglomerate which bit down into the seam, in places washing it out completely. Conditions became steadily worse and, after working some of the coal between the runners in the upper part of the tunnel, Mr. Wright was forced to abandon the colliery.

The "runners" are unlike any yet described in this report. They are all of a similar nature, varying only in minor details and in thickness and a description of one of them will be adequate. The "runner" in question is a wall-like stone body funnel-shaped in cross section cutting vertically through the seam and actually penetrating the shale floor. At the top it consists of shale similar to the roof shale, but it becomes sandy a foot or so from the roof and contains a number of waterworn pebbles. Its course through the seam is sinuous and small "feeders" may run along the bedding of the seam for an inch or two. The walls are ragged and in places the "runner" includes small fragments of coal. It causes no appreciable dislocation of the seam. The "runners" are extremely hard and compact and could not be pierced with coal-boring machines. They run approximately parallel with the strike of the seam (*i.e.* north-west–south-east) though they may depart from this direction by 20 degrees or more. In thickness they vary from an inch or two to more than six feet.

There thus occur in this pit three distinct types of "washout" phenomena: (1) The normal erosion of the seam by running streams shortly after its deposition and subsequent filling of the erosion channels with sand and gravel; (2) Replacement of the coal by fine carbonaceous shale without affecting the roof or pavement shales; and (3) "Stone intrusions" bearing a general resemblance to the "earthquake washes" described by Raistrick and Marshall (1939, pp. 92-95).

Types (1) and (3) are well known and do not call for any special explanations; but type (2) is most unusual and no thoroughly satisfactory explanation has suggested itself to the writer. The continuity of the roof stone over both washout shale and coal proves that the deposition of the former was complete by the time the coal was laid down; and yet deposition could not have been contemporaneous, for then there would be a gradual change from coal to shale. The nature of the washout shale suggests that it was deposited as a slurry of fine mud and plant fragments which could only be deposited in practically still water. On the other hand, the peat could hardly have been eroded under such conditions. It would appear that the peat must first have been eroded by swiftly running water without deposition of any of the expected coarse sediments, the stream course then dammed up and the excavation subsequently filled with fluid mud. Admittedly this seems rather far-fetched, but no simple explanation of the phenomenon seems to fit in with all the observed facts.

The section of the Aberdare Seam worked here is 7 ft. thick and comprises the "tops" augmented by most of the section of the "bottoms" that overlies the "badger." It includes nine stone bands and one or two bands of inferior coal. The balance of the seam lies 55 ft. below the worked section, the intervening strata being coarse sandstone. As exposed in a trial tunnel nearby it consists of twelve inches of coal on the roof, then four feet of coaly shale, and another twelve inches of coal at the bottom.

By prospecting under the Aberdare Conglomerate Mr. Wright traced the course of the Aberdare Seam through portions 95 and 97, without locating any workable coal. In portion 97 one of Mr. Wright's old tunnels which is still open reveals the following impoverished and attenuated section of the Aberdare "tops":—

	ft.	in.
Sandstone and Conglomerate Roof ..		
Inferior Coal	0	6
Lenticular Stone	0	0–2
Inferior Coal	0	4
Stone	0	1
Inferior Coal	2	0
Stone	0	0½
Coal	0	9

Some fifty feet below this seam there is another old tunnel, now inaccessible, on the bottom section of the Aberdare Seam. The roof stone is a 2 ft. bed of indurated, massive, cream-coloured shale.

About the same distance below this another old tunnel has been driven in the bank of Oaky Creek

on to a seam of coal, presumably the Bluff; but again the seam is not visible.

The general dip hereabouts is 20 degrees to 25 degrees to the south-west. Between portion 94 and Palmer's Aberdare Colliery in portion 98 there are a number of isolated outcrops of silicious conglomerate all identical in appearance and indistinguishable from the Aberdare Conglomerate. As no reverse dips have been found the distribution of the conglomerate can only be due to faulting; but the nature of the faulting is not understood. Further discussion on the conglomerate and associated coal will be found in the following paragraphs.

Palmer's Aberdare Colliery (abandoned).—In 1918 a tunnel was driven on what was believed to be the Aberdare Seam in portion 98, Bundamba. As the seam thus opened up proved to be of poor quality the tunnel was abandoned, but subsequent prospecting encouraged them to re-open the tunnel. It had been operating only three years when, in 1924, it was finally shut down. In the meantime a second tunnel had been opened up further south. This was abandoned in 1926.

Because of its occurrence only a few feet under the Aberdare Conglomerate, Palmer's Seam has always been correlated with the Aberdare. As measured by me, the seam has a thickness of 22 ft. No. 2 Tunnel, to which access was gained with some difficulty, was commenced in alluvium on the left bank of one of the headwaters of Oaky Creek and was driven through the partly eroded seam to the pavement. The bottom section measuring 4 ft. 3 in. was worked to a small extent in the upper part of the tunnel. Three chains from the entrance a fault with a downthrow of 12 ft. brings what Reid (1927) calls the middle section against the bottom section. This middle section on which most of the work has been done is 4 ft. 10 in. thick but the top four inches are only taken down to make height in the travelling roads. There are half-a-dozen stone bands aggregating 9 to 10 in., while some of the coal bands are of inferior quality. The roof stone of the middle section is a light-coloured, white shale called by Cameron (1920) "whinstone" and regarded by him as a volcanic sill. The rock was shown by Reid (*loc. cit.*) to be of sedimentary origin. Where seen by me this stone band was 9 in. thick but Cameron gives its greatest thickness as 19 in. It has the peculiar colouring characteristic of the big stone seen elsewhere about 6 ft. from the roof of the Bluff Seam, that is, cream to buff with a reddish band at the bottom. The presence of this stone, coupled with the absence of any of the usual Abedare bands, has led the present writer to conclude that the seam worked in *Palmer's Aberdare* tunnels is the Bluff, the Aberdare Seam and the strata between it and the Bluff having been completely removed by the erosion which preceded the deposition of the Aberdare Conglomerate.

The top section of the seam has been prospected eighty yards from the tunnel entrance. The section above the big stone here is 5 ft. 2 in. thick and includes seven stone bands aggregating 8 in. The excavations in the top section have revealed an erosion channel with sandstone coming down to within 18 in. of the big stone. This particular washout differs from others seen on the field in being narrow and steep-sided. Mr. Reid (*loc. cit.*) states that erosion of the seam (presumably the middle section) occurs over the last four chains in the lower west level. He also mentions a small decomposed dyke in the same part of the mine.

The conglomerate overlying the seam in No. 2 Tunnel can be traced intermittently down the left bank of the gully for some 11 chains. The conglomerate next outcrops roughly 10 chains to the south-west, on the left bank of the main creek, indicating a large dislocation. A trial tunnel has been driven here for a short distance on a seam of coal lying about 30 ft. under the conglomerate. The seam is 3 ft. 9 in. thick and consists chiefly of inferior coal and "bluey" with one lenticular stone band near the roof. Overlying the seam there is a cream-coloured unbedded stone 18 in. thick similar to that overlying the bottom section of the Aberdare Seam in Wright's trial tunnel in portion 97, suggesting that the top section, together with some of the underlying shales, has been eroded.

A small isolated outcrop of the conglomerate occurs four chains south-west of No. 1 Tunnel where it has undoubtedly been downfaulted.

Nine chains north-westerly from No. 1 Tunnel there is another isolated outcrop of Aberdare Conglomerate. In a trial shaft 20 ft. below the conglomerate there is exposed the crop of a seam 3 ft. or more thick, immediately overlying which there is a cream-coloured unbedded stone band 20 in. thick, which again suggests that the seam is the bottom section of the Aberdare Seam.

Yet another isolated outcrop of Aberdare Conglomerate occurs in portion 97, 22 chains west of No. 1 Tunnel. A seam of coal lying approximately 50 ft. below the conglomerate has been prospected by trial shafts along the western boundary of portion 98. There is no access to the shafts and the seam is nowhere visible. Some of the coal in the dumps is of moderately good quality.

The distribution of the Aberdare Conglomerate in the vicinity of Palmer's Aberdare Colliery is one of the most puzzling features in the geology of the Ipswich field. The various isolated outcrops have been carefully mapped and particular attention has been given to strikes and dips of the associated rocks. No simple system of faults seems adequate to account for the curious distribution of the conglomerate. It is depicted on the map as plotted from my traverses, the only faults shown being those actually observed.

CHAPTER 14.

PALMER'S ESTATE TO RHONDDA.

Binnie's Tunnel (abandoned) and Environs.—*Binnie's Tunnel,* which is still accessible, though abandoned for some forty years, is driven on a seam which I believe to be identical with that worked in *United No. 5 Colliery.* The same seam has been worked in the adjacent *Bonnie Dundee Extended Colliery.* The coal is seven feet nine inches thick. of which only four feet were worked. The coal is generally of poor quality though one or two obviously good bands do occur. The workings are reported to be of small extent only. The dip is 14 degrees to the east-south-east.

In recent years the New Aberdare Company has prospected the Bluff Seam in portions 155 and 156, Bundamba, to the east of *Binnie's Tunnel.* A shaft was sunk on to the seam worked in Hare and Wall's Tunnel but, according to Mr. J. Conway, Superintendent of Aberdare Collieries Pty. Ltd., it did not show a workable section. Other shafts sunk further east showed that the seam had deteriorated badly in that direction, and consisted of coaly shale with thin streaks of coal.

Hare and Wall's Tunnel is driven on a seam lying a few feet under the Aberdare Conglomerate. The main tunnel has completely collapsed at the entrance but a small tunnel nearby showed a section four feet thick under an eight-inch stone band similar to the big stone in *Palmer's Aberdare Colliery.* The coal was mostly inferior, and considerable difficulty must have been experienced by the proprietors in finding a market for it. There are four feet of coal with stone bands overlying the big stone but this section was badly weathered and its quality could not be assessed. The seam is believed to be the Bluff Seam with the lower part missing.

A diamond drillhole (Mullins') put down in portion 161, Bundamba, about a-quarter-of-a-mile down dip from *Hare and Wall's Tunnel* passed through eight feet of stone and coal bands (including one foot of good coal) at a depth of 535 ft., and a further "seam" 10 ft. 6 in. thick at 786 ft. These are believed to be respectively the Bluff Seam and the seam worked in *Bonnie Dundee Extended Colliery.* A considerable steepening of the dip going south-east from the outcrop is indicated by the bore. Surface observations also show increased tilting of the strata in this direction.

The seam in Binnie's Tunnel is approximately 250 ft. below the seam in Hare and Wall's Tunnel. It is believed to be identical with the unnamed seam worked in *United No. 5 Colliery* notwithstanding the abnormal thickness of strata between it and the Bluff Seam, which can be explained by the presence of three sandstone lenses aggregating about 100 ft. in thickness.

Bonnie Dundee Extended Colliery (abandoned).—After losing the Aberdare Seam against the Bonnie Dundee Fault the Bonnie Dundee Company prospected in portions 145 and 151, and in 1917 located what was considered to be the Aberdare Seam. A colliery was opened up on the seam and operated for six years.

The general strike of the seam is north and south and the average dip, so far as my observations went, about 8 degrees to the east. The seam is 9 ft. 6 in. thick but only the bottom section, measuring 4 ft. 8 in., was worked. This included two permanent stone bands as well as a number of lenticular ironstone bands which increased in size and number in depth and eventually were responsible for the closure of the colliery.

On the north the workings come to an abrupt end against the Bonnie Dundee Fault. The identity of the seam is discussed in the section dealing with Binnie's Tunnel.

Bonnie Dundee (old) Colliery (abandoned).—The colliery was commenced about the year 1901. The Aberdare Seam was worked for half-a-mile along the outcrop by a number of tunnels. As the company's property extended only an average distance of six or seven chains to the dip, except in the extreme south of the property, it was not long before the seam was worked out. In 1911 a vertical shaft was sunk to a depth of 481 ft. commencing in the roof shales of the Bluff Seam. From this shaft a seam, which the proprietors believed to be the Four Foot, was worked to a considerable extent. The colliery was abandoned in 1927.

Near the surface only a part of the Aberdare "tops" was present, the working section being, according to Cameron (1907), 4 ft. 8 in. to 5 ft. In No. 3 Tunnel, where the seam can still be examined, the thickness is 5 ft., with four stone bands aggregating 5 in. Mr. Cameron (*loc. cit.*) states that there are 8 ft. of unworkable coal and stone bands between the seam and the overlying sandstone.

The course of the seam is interrupted by a number of dip faults, and the workings terminate in the south against a fault with a downthrow to the north-east of about 80 ft. This fault is considered to be a branch of the main Bonnie Dundee Fault, which is some six or seven chains to the south-west. The Aberdare Seam was worked to some extent between the two faults, but it is reported to have deteriorated to the dip.

The Bluff Seam has been worked to a small extent between the two faults mentioned in the preceding paragraph. The worked section was 5 ft. 3 in. thick and it included half-a-dozen stone bands as well as a good deal of inferior coal. The big stone occurs 12 in. above this section, and over this there are some six feet of coal and stone bands.

The *Bonnie Dundee Shaft* is reported to have passed through five seams, including the Bluff. The second seam, known as No. 2, was met with at a depth

of 112 ft. (Cameron's unpublished eight-chain map). It has been fairly extensively worked and I was fortunate enough to be able to examine the old workings under the guidance of Mr. A. Dobbie, one of the proprietors of the colliery, access being gained by way of a tunnel (No. 6) driven from the outcrop. The working section of the seam varies from 3 ft. 4 in. to 4 ft. 4 in. Stone bands vary a good deal, increasing in number and size with depth. The roof measures usually comprise coal and stone bands but in places the roof stone and part of the seam are eroded and replaced by massive sandstone. The quality of the coal also deteriorates dipwards. A sample of the coal taken from the tunnel showed 21·2 per cent. ash. The identity of No. 2 Seam is doubtful. It is difficult to correlate with the seam in *Bonnie Dundee Extended Colliery* either in point of thickness or in its distance below the Bluff Seam; but it is comparable in both these respects with the seam in the same relative position in portion 12 (*Southern Cross Collieries*). There are no grounds for correlating it with the Four Foot Seam. The seam should be worth prospecting north of the faults near No. 6 Tunnel as its quality seems to be improving in this direction.

There is no record of the thickness or quality of the third, fourth, and fifth seams, which were met with respectively at 319, 441, and 481 ft. (Cameron unpublished eight-chain map), beyond a statement by the Inspector of Mines (W. E. Lawrie) in his annual report for 1911, that all the seams were considered workable. Cameron identified them as the Bergin's, Striped Bacon, and Rob Roy, but they seem more likely to be the Four Foot, Bergin's, and Striped Bacon. In view of the declining reserves of the field it may be worthwhile to re-condition the shaft in order to ascertain if any of the seams might be workable under existing conditions.

Blackheath Colliery.—The exhaustion of the Aberdare Seam in the *West Moreton Colliery* towards the end of last century led the proprietors to prospect elsewhere and resulted in the discovery of the Aberdare Seam on the eastern limb of the Bundamba Anticline. For some years the colliery was worked under the name of *"New West Moreton"* but about 1906 it was re-named *"Blackheath."* It was here in 1907 that coal-cutting machines were used for the first time on the Ipswich field and probably in Queensland. In 1920 a shaft was sunk to the Four Foot Seam, which was worked to a small extent. The property was purchased by the A.U.S.N. Co. Ltd. in 1917. For many years the coal was worked from the two original tunnels; but as the workings spread south haulage and ventilation difficulties made it necessary to drive another tunnel, and in 1924 *No* 3 *Tunnel* (generally known as *"Siberia"*) was driven in portion 144, Bundamba. As the seam was 420 ft. below the surface at this point the tunnel had to be driven through the overlying Bundamba Series. It was started in an easterly direction but as the dip of the sandstones steepened the tunnel was turned and driven for the last eight chains in a north-westerly direction against the dip of the measures. This section of the mine is now completely worked out and the tunnel has been abandoned. In 1937 a stone drive was started from No. 1 Tunnel. It reached the Four Foot Seam three years later, but exploitation of the coal was delayed pending the driving of a companion ventilation dip which was not completed until 1942. This section of the mine is equipped with mechanical scraper-loaders, the first to be used on the field, as well as coal-cutting machines. Both No. 1 and No. 2 Tunnels are equipped with endless haulage.

Development of the Aberdare Seam ceased some years ago and pillars are now being extracted. Pillar work was commenced at the south end of the mine and is now approaching No. 2 Tunnel. To date there have been no major creeps or fires, and recovery of coal from pillars has been most satisfactory.

The worked section of the Aberdare Seam in *Blackheath* varies from 8 ft. to 17 ft. As exposed in collapsed workings near the crop in portion 126 the seam is 10 ft. 4 in. thick. The "tops" are 7 ft. thick (slightly thicker than usual); then follows the top "badger" and under this is the top section of the "bottoms" some 2 ft. 6 in. thick. Overlying the "tops" there are 4 ft. of coal and stone bands (usually called the "clod"), then 6 ft. 6 in. of shale, and above the shale 4 ft. 6 in. of coal. This coal is very weathered and hence its quality is doubtful, but it is without any major stone bands. It does not appear to have been worked at all; and as it must have been seen in a number of air shafts it would seem that either the coal is not of workable quality or else the seam is highly lenticular.

To the dip the "clod" improves in quality and has been worked over a wide area. This gives the seam its unusual thickness (14 ft. or more) in the area about Nos. 1 and 2 Tunnels. The prominent band of "bluey" that occurs 3 ft. 6 in. to 4 ft. from the roof is considered to represent the base of the "clod." South of No. 2 Tunnel the lower part of the "tops" and the whole of the "bottoms" are wanting, the usual thickness being 8 to 9 ft. Here also the Aberdare "Conglomerate" (usually silicified sandstone) comes down on to the seam and in places partially replaces the "clod."

In the upper parts of the mine the bottom section of the "bottoms" is reported to lie from 3 to 7 ft. under the worked section. It has been tested here and there but only worked to a slight extent. In the one place where it is still visible this section is 4 ft. 4 in. thick. There is a three-inch shale band nine inches from the roof, but, according to the manager, this band is usually ten to twelve inches thick. The coal is of inferior quality and it carries a large number of penny bands. A sample from which the larger stone bands had been excluded gave an ash yield of 22 per cent. Going east this seam is reported to have been found at increasing distances below the main seam.

The Aberdare Seam is claimed by the manager to have been worked to its limits throughout the pit. In the extreme south the workings terminate against

(1) the Bonnie Dundee Fault and (2) a line of inferior coal. The Bonnie Dundee Fault, as described by the manager, Mr. G. Marshall, is a wide zone of faulting which throws up the seam in stages. The coal was actually worked in two or three of the "steps." To the dip the coal became inferior along a line running north-east from the Bonnie Dundee Fault. After twenty chains the line of inferior coal turned and ran roughly north for half-a-mile. In the "Siberia" workings the coal gradually deteriorated and eventually turned into black stone. A diamond drillhole put down by the New Aberdare Company in portion 156 was designed to test the seam at a greater depth, but owing to the steepening of the dip in this direction the depth reached (760 ft.) would not have been sufficient to reach the horizon of the Aberdare Seam. Further north the "bluey" band increased in thickness and the coal above and below it decreased to such a degree that the seam became unworkable. Thus at the face of Lindsay's Dip the "bluey" (here very stony) occupies 2 ft. of a total section of 6 ft. 6 in. to 7 ft. About No. 2 dip the coal goes rather deeper, but in the face of the dip the seam, which in any case was becoming difficult to work on account of the thickening of the "bluey," was washed out to within nine inches of the floor and replaced by sandstone. In the face of No. 1 Tunnel the seam is replaced by black shale, while north of the dip, in the deep workings, stone runners similar to those in *"Green Gully" Tunnel* made their appearance, and so increased in size and number that the seam became unworkable. About half-way down No. 1 Tunnel the levels going north ran into a "washout" the exact nature of which is not known. Only to the rise of this "washout" was the seam worked to the northern boundary, but even here it was lost a few chains beyond the boundary.

The Bluff Seam has been worked to a small extent in portions 127 and 128, Bundamba, under the name of "Little Jim" Seam. The tunnels are not accessible but the manager reports that the seam was only 5 ft. thick and only the lower 2 ft. 6 in. were worked. In the stone drive from No. 1 Tunnel the seam is 4 ft. 6 in. thick and the coal is very inferior. In portion 126, where exposed in a trial tunnel, the Bluff Seam is at least 9 ft. thick. The big stone, already reported from a number of collieries, lies in about the middle of the section. The coal is said to be of inferior quality.

In portion 128, Bundamba, there is a trial tunnel on a seam lying between the Bluff and the Four Foot. In section the seam is similar to Bonnie Dundee No. 2 Seam. In the stone drive from *Blackheath No. 1 Tunnel* this seam lies approximately 80 ft. below the Bluff Seam. It is 5 ft. 6 in. thick and of unworkable quality. A diamond drillhole put down in portion 126 from the pavement of the Bluff Seam passed through black shale and coal bands from 134 ft. 6 in. to 137 ft. This is in all probability the unnamed seam prospected in portion 128.

The Four Foot Seam in *Blackheath Colliery* has a working section varying from 5 ft. 1 in. to 7 ft. 3 in., the average being about 5 ft. 6 in. They are working the "brushing" band, that is, the band of coal above the double white stone. In *Blackheath* this band varies from 11 in. to 1 ft. 5 in., while the main Four Foot Seam varies from 3 ft. 9 in. to 5 ft. 6 in., and averages about 4 ft. 3 in.

To the rise of the stone drive workings the Four Foot Seam is reported to deteriorate, particularly as regards the lower 12 to 18 in. In a trial tunnel in portion 129, Bundamba, there are less than 2 feet of workable coal below the double white band.

The "Top Coal," which is generally regarded as part of the Four Foot Seam, even though it is not known to occur on the western limb of the Bundamba Anticline, lies 8 ft. or more above the main Four Foot Seam. The seam is 5 ft. 8 in. thick and carries six permanent stone bands totalling 8½ inches as well as a number of lenticular bands. It has not yet been worked, but it is proposed to test it as workings on the Four Foot Seam expand, because with very little improvement it could be classed as a workable seam.

None of the lower seams has yet been seen within the limits of the existing workings. In portion 129 the Bergin's Seam is reported to lie 3 ft. under the Four Foot Seam, while toward the southern boundary of the same portion the ?Striped Bacon Seam has been prospected. I was not able to examine either seam. The Bergin's Seam has been worked in the adjacent Bonnie Dundee No. 2 Colliery where it was workable in the shallow ground but deteriorated in depth, and it is probable that the seam will be worked in *Blackheath* at some time in the future.

As regards future prospects, there is no immediate cause for disquiet. Provided major creeps can be avoided it is estimated that the Aberdare pillars will last for ten years at the present rate of extraction. The Four Foot Seam is developing well, but the workings to date have not spread far from Bonnie Dundee No. 2 boundary. In the diamond drillhole in portion 126 (referred to above) dark shale with streaks of coal were reported from 390 ft. to 396 ft. 6 in. and dark shale and coaly streaks with one 12 in. coal band from 408 ft. to 414 ft. These are in all probability the Top Coal and the main section of the Four Foot Seam; and it does not augur happily for the extension of the Four Foot as a workable seam in that direction, though an improvement to the dip of the bore would not be unexpected.

Fernie Creek Colliery (abandoned).—The colliery was opened on the Aberdare Seam early in the century but owing to washouts and fires it was abandoned before many years had passed. It was taken up again by H. G. Noble Ltd. in 1918 and worked from a new tunnel as **Noblevale No. 4** until 1923, when it was finally abandoned. The pit is now included in *Bonnie Dundee No.* 2 property.

The main tunnel is driven almost due east from the western scarp of a hill capped by coarse silicious sandstone (Aberdare Conglomerate). It lies only two or three chains from *Blackheath* boundary. In the upper part of the mine the northern levels ran into the crop, as the ground falls away rather sharply in this direction. Further down they encountered the "washout" coming across from *Blackheath.*

H. G. Noble Ltd. gained access to the seam by driving a stone drive through a bed of shale which replaces the seam, as in the *"Green Gully" Tunnel.* Detailed observation of the shale-coal junction was not possible owing to bad air in the tunnel; but it seemed that the coal first appeared in the roof, and not in the floor as in "Green Gully" Tunnel.

According to Cameron (1907) only the "tops" were present in this colliery, the thickness being 6 ft. 2 in.

The Bluff Seam has been prospected by a couple of shallow cuts and found to consist chiefly of coaly shale with only thin bands of coal. Some seven chains west of No. 2 Tunnel silicious sandstone similar to the Aberdare "Conglomerate" in this area makes its appearance over the Bluff. Seam. It is really at this point that the Aberdare Conglomerate loses its identity, as it cannot be distinguished from the underlying and overlying bands of silicious sandstone in *Noblevale No.* 1 and *Rhondda Collieries* or beyond, nor has any seam identifiable as the Aberdare Seam been found north of Fernie Creek Colliery.

Bonnie Dundee No. 2 Colliery.—In 1901 the Four Foot Seam was opened up in three tunnels, known respectively as **Sunrise (Wall's),** *Hunter's,* and *Reid* and *Archibald's* in about the middle of portion 286. Of these only *Sunrise* produced any appreciable quantity of coal, but it was abandoned within a few years. In 1921 the *Sunrise Tunnel* was re-opened by the Bonnie Dundee Colliery Co. under the name of *Bonnie Dundee No.* 2 *Colliery,* and it has worked continuously ever since.

Two seams have been worked, the Four Foot (including the Top Coal) and the Bergin's. Near the surface these two seams are no more than 3 ft. apart but they are reported to diverge going east. The working height of the Bergin's Seam varies from 3 ft. 4 in. to 5 ft. 6 in., the thickness increasing toward the east. The seam does not carry any permanent stone bands, but frequently a stone band up to 2 in. in thickness is seen about seven inches from the pavement, while "penny bands" are always present and are sometimes numerous. The quality of the seam is reported to deteriorate going east and it is only in the upper part of the mine that it has been worked. The main dip is driven for most of its distance on the Bergin's Seam from which stone drives are put out at intervals to the upper seam.

The Four Foot Seam has been extensively worked. The main tunnel goes down in a south-easterly direction for a distance of 28 chains to the *Blackheath* boundary from where a haulage road goes north-east along the level course of the seam for 20 chains to a second dip 26 chains long bearing slightly south of east. Near the mouth of the main tunnel a cross dip is driven 24 chains in a south-south-westerly direction to the *Blackheath* boundary. From here the coal is being developed by a dip going slightly north of west. The cross dip at a point 20 chains from the main dip is on the axis of the Bundamba Anticline and also on the axis of a synclinal cross fold; so that for the last four chains the "dip" is actually a "rise." The dip of the coal gradually steepens going west from the cross dip.

Until recently only the coal below the two white bands was worked, but now the "brushing" band is also being taken down. The quality of coal in the "brushing" band is not bad but it often carries a number of shale partings. In the main section of the seam there is in the eastern workings a band of inferior coal or "bluey" about one inch thick about twelve inches from the pavement. Going west this band increases in thickness and develops shale partings. In the cross dip near Blackheath boundary it is seven inches thick, and in a trial tunnel in portion 129 the bottom eighteen inches of the seam are unworkable. In places a band of "bluey" one inch or more thick lies immediately under the two white bands.

The Top Coal is mostly between 8 and 12 ft. above the main Four Foot Seam. The intervening measures carry some bands of coal but shale partings are excessive and no workable section is known. The worked section of the Top Coal is 6 ft. to 6 ft. 4 in. thick, including two stone bands each two inches thick and a "badger" five to nine inches thick, as well as a number of shale partings. The last-named are responsible for the rather high ash content of the coal as shown by my sampling, but considerable improvement is effected by washing. This seam has only been worked to a small extent as yet, but it is the intention of the management to exploit it on a comparatively large scale in the near future.

In the deeper ground a good deal of trouble has been experienced with faulting. The main faults are the *Blackheath* and a parallel dislocation striking about 30 degrees east of north. In No. 2 Dip the seam is thrown up 12 ft. by the Blackheath Fault. North of the dip the fault grows a little, while a number of minor faults appear east of it, all striking east-north-east–west-south-west. Approaching the Redbank Plains Road (and the old *Noblevale No.* 1 workings) the faulting takes the more usual west-north-west–east-south-east course.

The lower seams, where tested, have proved disappointing. A seam lying 50 ft. below the Bergin's Seam has been tested in a trial shaft near the main tunnel entrance. The reported thickness of this seam is 5 ft. 1 in., including twelve stone bands with an aggregate thickness of 1 ft. 2 in. As the Bergin's Seam as worked in this colliery has only about half its normal thickness it is possible it may be split

and the seam in the trial shaft may be the "bottoms." Approximately 50 ft. below this seam another seam has been investigated in a second trial shaft. This seam is 5 ft. 5 in. thick and carries 1 ft. 8 in. of stone in four bands. It may be the Striped Bacon or perhaps the Rob Roy. Two seams in the Cooneana Stage have been prospected by trial shafts. The upper seam was 3 ft. 2 in. thick and included a band of stone eight inches thick. The lower seam was 2 ft. 8 in. thick including six inches of stone in three bands. The coal was of inferior quality.

The future of the colliery must depend largely on the ability of the management to produce a marketable coal from the Top Coal of the Four Foot Seam; this will demand care in washing the greater part of the coal before marketing. It is estimated that there are more than three-quarters-of-a-million tons of coal in this seam within the limits of the existing workings.

Future supplies of Four Foot coal will be drawn from (1) the deep ground east of the existing workings, (2) the area between the cross dip and the western boundary of the property, that is, in the direction of *Aberdare No.* 4 *Colliery,* and from old pillars. There is little to guide one in estimating the depth to which the seam may maintain its workable quality. There seems to have been some deterioration of the coal in the deepest workings of the adjacent *Noblevale No.* 1 *Colliery,* though as yet there is on indication of it in *Bonnie Dundee No.* 2. In the direction of *Aberdare No.* 4 *Colliery* the bottom 18 inches of coal become unworkable but with the "brushing" band the seam is still thick enough to work. The estimated reserves in this section are 200,000 tons. So far as is known there are no reserves in the Bergin's Seam outside of pillars, unless the seam should improve towards the west. This could be ascertained by sinking below the Four Foot Seam as the dip advances in this direction.

Noblevale No. 1 Colliery (abandoned).—This property (now owned by the Rhondda Company) lies between Bonnie Dundee No. 2 and Rhondda. The first official mention of *Noblevale No.* 1 *Colliery* is a statement in the Annual Report of the Mines Department for 1911 that a coal cleaning and screening plant had been installed there. Prior to this the colliery was known as **Wattle Glen** or **Bogside No. 3.** It is believed to have been opened up originally about 1906 or 1907. The main pit was abandoned in 1938. No. 3 Tunnel was commenced in 1940 and continued to operate after the property changed hands. A great deal of trouble seems to have been experienced with fires, rather surprisingly, as the Four Foot Seam is not as a rule liable to spontaneous combustion. A good deal of pillar coal was lost presumably owing to this cause.

Both the main section and the Top Coal of the Four Foot Seam were worked, the latter to a relatively small extent. I was able to measure the section of the main Four Foot Seam near the entrance to No. 1 Tunnel. The thickness of coal under the two white stone bands is 3 ft. 5 in. including one inch of "bluey" at the top. The "brushing" band is 1 ft. 10 in. thick, and carries two stone bands respectively one inch and one-and-a-half inches thick. It is understood that only the bottom 3 ft. 5 in. of coal were worked. The Top Coal which could not be viewed is believed to be 12 to 14 ft. above the main seam.

The greater part of the coal was worked from No. 1 Tunnel, the workings reaching a point fifty chains from the outcrop of the seam. Later two additional tunnels were driven to reach the coal on the south side of a fault striking east-south-east–west-north-west. This fault was described by Mr. J. H. Reid (unpublished report dated 23rd February, 1927) as a reverse fault dipping north-north-east. The amount of displacement of the coal was not stated, but according to a noting on the map accompanying the report the displacement was small where the fault crossed the boundary of portions 1V and 281. The plan shows two faults with a similar strike in portion 283 (sub. 4).

The Bergin's Seam is reported to lie five feet under the Four Foot Seam except in the southern workings, where the two seams come together. It does not appear to have been worked.

Noblevale No. 1, No. 3 Tunnel.—This tunnel was commenced in portion 280 by H. G. Noble Ltd. in 1940, and is now being worked by the Rhondda Co. The outcrop of the seam on which it is driven lies 1½ chains behind (or 25 ft. below) the expected position of the Four Foot Seam if there were no displacement on the reverse fault. As the seam would be thrown down to the south on the fault the seam lies in about the position where the Four Foot Seam should be. The seam worked, however, bears no resemblance to the Four Foot and its identity has been a great puzzle to the management.

The section of the seam in No. 3 Tunnel is as follows:—

	ft.	in.
Coal	0	5
Shale	0	1
Coal	0	6
Stone	0	1
Coal (with lenticular stone band) ..	0	7
White Stone	0	2
Coal	0	4
Yellow Stone (with leathery parting)	0	3
Inferior Coal	0	2
Stone	0	1
Coal (with lenticular stone band) ..	1	8
Total ..	4	4

This seam bears such a striking resemblance to a section of the measures overlying the Four Foot Seam in *Bonnie Dundee No.* 2 and *Blackheath*

Collieries that there can be little doubt as to the identity of the sections. A section measured in *Blackheath Colliery* is given below for comparison:—

	ft.	in.
Inferior Coal (with lenticular Stone Bands)	2	3
Light-coloured Stone	0	3½
Inferior Coal	0	4
Yellow Stone (with leathery parting) ..	0	3
Coal (with lenticular Stone)	2	1

Yellow stone bands are uncommon in the Ipswich coal seams while leathery partings are extremely rare. A combination of the two must surely be unique. In both cases the yellow stone is separated from an overlying band of light-coloured stone by four inches of coal. The only difficulty in the way of accepting the correlation is that neither the main Four Foot Seam nor the Top Coal is present in *Noblevale No.* 1, *No.* 3 *Tunnel.* The seam is overlain in turn by two feet of coaly shale and at least ten feet of sandstone, while a bore put down 40 ft. below the floor of the seam passed through beds of shale and sandstone without any coal. It would appear that the seam is either split into three sections here or that the missing sections are washed out. It might be mentioned that the splitting of the Four Foot Seam is not unknown on the field. For example in *Rylance No.* 3 (*New Chum*) *Colliery* the Top Coal is separated from the main seam in one place by at least seventy feet of sandstone.

The tunnel comes to an abrupt end against a fault dipping east-south-east at 40 degrees 220 yards from the entrance. To the north the levels terminate at the reverse fault previously referred to, while to the south the colliery boundary bars further development. Pillars are being extracted.

Noblevale No. 1, No. 4 Tunnel.—This tunnel, commenced in 1943, lies some fourteen chains west of No. 1 Tunnel. The seam on which it is driven is 230 ft. below the Four Foot Seam; and unless there is a considerable local thickening of strata the seam must be in the Cooneana Stage. There are altogether nine feet of coal and stone bands but only the bottom five feet are considered workable. The worked section carries seven stone bands of an aggregate thickness of 1 ft. 2½ in. With careful mining the larger stone bands can be eliminated but the smaller bands go to the washery. Provided there is no deterioration and the coal is carefully mined a large tonnage of coal may be won from this pit, which is still in its infancy.

A trial tunnel has been driven on beds of coaly shale in portion 283A, supposed to be the Aberdare Seam. They are sandwiched between massive sandstone beds and lie over 400 ft. above the Four Foot Seam. The horizon appears to be approximately that of the Aberdare Seam.

Blackheath No. 1 *D.D.*—This hole was drilled in R. 384 near the Redbank Plains Road to a depth of 328 ft. Three inches of coal at 180 ft. are possibly representative of the Aberdare Seam. Ninety feet below this the bore passed through 25 ft. of black shale—possibly the horizon of the Bluff Seam.

Barker's Shaft.—This old prospecting shaft, which is in the north-west corner of portion 282, is reported to be 200 ft. deep. Sandstone constitutes the bulk of the spoil dump, but a little coaly shale is also present. This shaft may not have reached the horizon of the Aberdare Seam.

Rhondda Colliery.—The Four Foot Seam was opened up by a tunnel on the Rhondda Estate in the closing years of the nineteenth century. The tunnel was soon abandoned in favour of a shaft (No. 1) from which the seam was extensively worked. Later a second shaft was sunk further to the dip, intersecting the Four Foot Seam at a depth of 299 ft. It was later decided to work all the coal from one shaft, and No. 2 Shaft was closed down. No. 1 Shaft has been sunk to the Striped Bacon Seam, which lies at a vertical depth of 242 ft. At present three seams—the Bergin's, the Striped Bacon, and the Rob Roy—are being exploited.

The Four Foot Seam is reported to be worked out. There is some disagreement as to the condition of the seam in the dip face, but it is believed that the coal had deteriorated somewhat. The main section of the seam, measured in No. 1 Shaft, is 5 ft. 5 in. thick under the two white stone bands. This section includes two light-coloured stone bands each two inches thick and separated by one inch of coal fifteen inches above the pavement. The Top Coal was not visible and there is no record of the section of it as worked in this pit. The Top Coal workings are not extensive and lie wholly to the south of the shaft. Evidently the seam deteriorates going north, as it was not workable in the adjacent *New Whitwood No.* 1 *Tunnel.*

The outcrop of the Four Foot Seam has been traced almost continuously across the property from south to north. It lies practically along the foot of the long easterly slope of Cooneana Ridge. Because of a flattening of the dips toward the summit of the ridge there is a small oval-shaped outlier of the seam along the summit. There is only a small amount of cover over the seam here, and the coal has been destroyed by weathering.

The Bergin's Seam lies at a depth of 171 ft. in No. 1 Shaft. The average thickness of the seam is 13 ft. Originally only the top section, about 6 ft. thick, was worked. This section includes six or seven lenticular stone bands aggregating six to seven inches. Recently they have been lifting the bottom section which is 6 ft. 6 in. to 7 ft. or more thick. It includes about a dozen lenticular bands of shale, "bluey" or ironstone. The tops and bottoms are separated by eighteen inches of stone and coal bands. In the dip workings the coal in the bottom section rapidly deteriorates, and is considered by the management too poor to work by the time the fourth level is reached. I was able to go down the dip as far as No. 2 Shaft where the top section showed

signs of deterioration. Still further down the dip it is reported to have become very stony and quite unworkable.

In the southern part of the colliery the Bergin's Seam lies no more than 5 ft. 6 in. below the Four Foot, the intervening beds being shale. It was the presence of the old collapsed workings on the Four Foot Seam immediately above the Bergin's Seam that prevented the latter from being worked right to the southern boundary. Going north the interval between the two seams increases rapidly, due partly to an increase in the thickness of the shale and partly to the appearance of a lens of sandstone. In No. 2 Shaft the two seams are reported to be 56 ft. apart, the sandstone lens here being 12 ft. thick and separated from the Bergin's Seam by 11 ft. of shale. Near the northern boundary of the property the seams are almost 90 ft. apart and the sandstone is as much as 50 ft. thick. The sandstone is usually separated from the Bergin's Seam by several feet of shale; but at the shaft level and for a couple of hundred yards down the dip the shale disappears and the sandstone comes in contact with the coal and may even replace the top few inches of the seam. Near the shaft the roof is extremely irregular due to the presence of innumerable molds of tree stumps.

The Striped Bacon Seam, which lies 70 ft. vertically below the Bergin's Seam in No. 1 shaft, is usually about 5 ft. 2 in. thick, but it may be as much as 6 ft. It carries as a rule eight or nine bands of stone or "bluey" aggregating from seven inches to eighteen inches or more. The seam shows a decided improvement going down the dip, the stone bands being thinner and fewer in number. The stone bands are mostly lenticular, but there is a constant light-coloured stone three to four inches thick 2 ft. 3 in. from the roof. The coal is worked extensively to the rise, the dip workings being in the early stages of development.

The Rob Roy Seam lies 61 ft. (pavement to pavement) below the Striped Bacon Seam, the intervening 54 ft. of strata being shale, sandstone, and ironstone in thin alternating beds. The workings are not sufficiently extensive to show what the average thickness is, but most of the faces examined were 6 ft. or more high. The seam carries a "badger" about two feet from the roof and there are, in addition, usually five or six variable stone bands. The roof is a black shale with a somewhat waxy streak. Access to the Rob Roy Seam was gained by driving a level stone drift from the shaft bottom on the Striped Bacon Seam.

The area is remarkably free from faults. Only one small fault was seen by me apart from the main Rhondda Fault, which cuts off the seams in the north. A large dyke crosses the workings from north to south, but there is no appreciable dislocation of the strata along it. Towards its intersection with the Rhondda Fault there are a number of offshoots, one of which follows a minor fault. In places the dyke runs for short distances (up to 15 ft.) along the seam causing some destruction of the coal. The seams are coked for a couple of feet on both sides of the dyke. Two small and apparently isolated dykes were seen in the rise workings on the Striped Bacon Seam. They have caused only slight inconvenience and practically no loss of coal. The Rhondda Fault strikes east-west and hades to the north at a steep angle. It does not appreciably dislocate the outcrop of the Four Foot Seam, but some twenty chains to the dip the seam is reported to be thrown down 120 ft. to the north. No coal has been worked north of the fault in portion 275. It is expected that the continuity of the seams in this area will be broken by the fault which cut off the coal in New Whitwood No. 1 Tunnel in portion 270.

The Bluff Seam has been tested in two or three different parts of the property, but it does not appear to have a workable section. Part of the crop was visible in a trial tunnel near the western boundary of portion 273. The greater part of the top section above the big stone is missing, being represented by no more than ten inches of coal and shale. The roof is silicious sandstone, the lowest of a succession of such beds which are crossed going in an easterly direction for a distance of a quarter-of-a-mile, where they become obscured by the alluvium and/or Tertiary beds skirting Six Mile Creek. In No. 2 Shaft the Bluff Seam is reported to be 14 ft. 6 in. thick, but excessively banded.

There is an old trial tunnel in portion 273 on a bed of what appears to be inferior coal and shale. This crop lies 15 chains east of the outcrop of the Bluff Seam. It is at least 200 ft. above the latter and thus would appear to be well above the horizon of the Aberdare Seam.

Though it has been in continuous operation for 45 years and at the moment has the largest output of any colliery on the field, the Rhondda pit is far from played out. In the first place there are some thirty acres in portion 275 where no coal has yet been touched. The four worked seams in this area are expected to yield at least three-quarters-of-a-million tons of coal. Outside of portion 275 the Four Foot Seam is worked out, but there are substantial reserves in the "bottoms" and in pillars in the Bergin's Seam. Rise workings on the Striped Bacon Seam are approaching the crop except in the extreme north; to the dip development is still in the early stages and the seam is showing considerable improvement as they go down. From No. 1 to No. 2 Shaft reserves are approximately a-quarter-of-a-million tons. Large reserves are indicated in the Rob Roy Seam provided it maintains its existing quality and thickness. Between No. 2 Shaft and the outcrop reserves are estimated at over 800,000 tons. In all seams reserves of 2,000,000 tons are considered to be reasonably assured. At the current rate of output (say 80,000 tons annually) the life of the pit should be at least 25 years.

CHAPTER 15.
DINMORE AREA.

New Whitwood Nos. 1 and 2 Tunnels.—A tunnel was driven on the outcrop of the Four Foot Seam near the southern boundary of portion 271, Goodna, in 1938, to work an area of coal thrown up out of reach of the main Whitwood workings by faulting. They met a fault in the face of the dip twelve chains from the outcrop which limited operations in this direction, while on the north the workings were limited by the fault that cut off the coal from the main workings. The pillars were drawn and the tunnel was abandoned in 1943.

The worked section of the Four Foot Seam here is 3 ft. 3 in. to 3 ft. 8 in. thick, the pavement being a six-inch stone band (equivalent to the lower double band in *Rhondda*) which overlies twelve inches of coal. The "brushing" band is 13 inches thick but is too inferior to work. The coal is of good quality but it is inclined to fall to slack and has a tendency to cake in the furnace. As the extraction of pillars was in a fairly advanced stage at the time of inspection I could not examine either of the bounding faults. Neither was it possible to inspect the Top Coal which had been reached by a stone drive near the dip face. The manager reports that one room was driven on this section of the seam. The coal was 7 ft. 6 in. thick but was not of marketable quality. It was separated from the main seam by 12 ft. 6 in. of shale with coal bands.

No. 2 Tunnel was commenced on the outcrop of the Bergin's Seam four chains west of No. 1 Tunnel entrance. Sixteen yards down the dip the seam is thrown down below the floor of the tunnel by a fault. The tunnel was driven through sandstone for a short distance and temporarily stopped. The outcrop of the seam was found on the south bank of a steep gully and it was later found under the massive sandstone capping the north bank. To reach this coal they broke off a place ten yards below the tunnel entrance and drove round the head of the gully which was only a chain from the tunnel mouth. The seam is between 12 and 13 ft. thick as in the Rhondda workings across the boundary. In these rise workings the sandstone is in contact with the seam which is eroded in places to a small degree.

The management, assuming the downthrow on the fault at the dip face in No. 1 Tunnel to be 70 ft. or thereabouts, proposes to continue the tunnel on the lower seam through that fault in the expectation of striking the Four Foot Seam at about the same level as the Bergin's Seam. It is estimated that there are some twenty acres of unworked coal in portion 270 east of No. 1 Tunnel.

Whitwood No. 3 Colliery.—This property, which originally comprised portions 267, 270, 271, 272, Goodna, was taken up in the first place by Mr. Lewis Thomas about 1870 as the **Old Aberdare Colliery**. Mr. Thomas drove a tunnel on the Bluff Seam (then known as the "Old Aberdare" Seam) in portion 267, but as the coal was rather inferior the seam was not extensively worked. The property appears to have lain idle for a good many years until purchased early in the century by Stafford Brothers, proprietors of *Whitwood Colliery* north of *New Chum*. A shaft (No. 3) was sunk to the New Chum Seam, which was worked extensively. Subsequently (in 1911) the shaft was sunk down to the Bergin's Seam, and eight years later they drove through the underlying strata to the Striped Bacon Seam. The property was taken over in 1926 by Messrs. Darker Brothers and worked by them until 1937, when it was purchased by New Whitwood Collieries Pty. Ltd., one of the Aberdare Collieries group. In the meantime No. 3 Tunnel had been driven through the New Chum Fault from a point near the railway siding (in portion 265) and most of the Four Foot coal was drawn to the surface through this opening. Later an endless haulage was laid from No. 3 Shaft to the siding and the use of No. 3 Tunnel for haulage was discontinued. The property now embraces portions 269, 268, 265, and 264, which were formerly included in Gulland's *New Chum Colliery*.

The Bluff Seam has been worked (in every case to a small extent) in three separate tunnels one of which, Thomas', has already been mentioned. Stafford Brothers drove two tunnels, one in portion 265 and the other in portion 268 south of the New Chum Fault. The section worked was the Tops above the big stone ranging from 6 ft. 7 in. to 8ft. 10 in. Below this section there are some twenty feet of coal and stone bands. The seam as worked carries numerous bands and some of the coal is rather inferior. Nevertheless the Company might be well advised to make some tests to ascertain the effect of washing, as there are considerable reserves in the Bluff Seam.

The main Four Foot Seam (also known as the New Chum or No. 2), as exposed in Gulland's old workings has a working section of 3 ft. 3 in. below the two white stone bands. Under the worked section there is a lenticular band of ironstone (argillaceous iron carbonate) up to five inches thick, and then follows a further twelve inches of coal. The "brushing" band above the white stones is eight inches thick.

The Top Coal (called No. 1 Seam in this colliery) is separated from the main seam by 11 to 14 ft. of stone and coal bands. The working section varies from 5 ft. to 7 ft. and averages 5 ft. 6 in. Included in this section there are two to five lenticular stone bands, as well as a number of shale partings. The quality of the Top Coal is very much better in *Whitwood* and *Rylance Collieries* than elsewhere, though still much inferior to the main or New Chum Seam.

Bergin's or No. 3 Seam is 80 ft. below the Four Foot Seam in No. 3 Shaft, the intervening strata being almost exclusively massive sandstone. As in Rhondda the coal is divided into two roughly equal sections by a foot or more of shale with coal bands.

the total thickness being about 13 ft. The top section, which alone appears to have been worked to any extent, includes as a rule two or three lenticular stone bands as well as a number of shale partings. The bottom section, though somewhat inferior to the "tops," is nevertheless quite a fair seam, and no doubt it will be worked wherever the top section is worked. It is usually just under six feet thick and carries five or six lenticular stone bands most of which are less than one inch thick.

Approximately 50 ft. below the Bergin's Seam they are working the Striped Bacon (No. 4) Seam. The section usually worked varies between 3 ft. 9 in. and 4 ft. 6 in. in thickness and includes two to four stone bands and a couple of shale partings. Underlying this there is a yellow stone band three inches or more thick, and then a foot of coal. The full section has been worked only in a few places.

The Rob Roy Seam has not been seen in Whitwood. I anticipate that it will be of very fair quality, as the coal was improving in both Rhondda and Rylance Collieries in this direction.

Nos. 3 and 4 Seams have been extensively worked to the rise but the dip workings, particularly on No. 4, are still in an early stage of development.

In dip workings from No. 3 Shaft the general dip of the seams is southerly, though considerably modified by the Gilliver disturbance. As was pointed out in Chapter 3 (p. 19), the Main Gilliver Fault does not continue across the *Whitwood* workings in a south-easterly direction as shown on Mr Cameron's 1923 map, but curves first to the south and then to the south-east, gradually losing intensity. The workings are crossed by two faults striking north-west–south-east which, where seen by me, cause very slight vertical displacement of the coal. The folding of the strata between them, however, (particularly evident on the plan of the Four Foot workings) suggests that there may have been considerable horizontal movement along them. A number of faults are shown on the plan of the Four Foot workings, but as there is no access to this part of the mine they could not be examined. To the rise of No. 3 Shaft faulting is much less in evidence, the only serious dislocation seen here being the New Chum Fault which throws the seams down some 200 ft. to the north-north-east. An incomplete plan of *New Chum No. 4 Tunnel* workings shows four faults between that opening and Whitwood No. 3 Tunnel, two striking north-west–south-east and two north-east–south-west. The plan also shows a north-south fault east of the tunnel, beyond which the coal was not worked. **New Chum No. 4 Tunnel** was driven through the New Chum Fault to the Four Foot Seam. According to Cameron (1899) the fault could be seen at the mouth of the tunnel, but the plan shows it crossing the tunnel more than a chain from the entrance. There is no sign of the fault in the cutting at the end of the railway siding alongside the mouth of the tunnel

The Four Foot Seam is worked out except for one or two small areas which include the twenty acres in the southern part of portion 270 referred to in the section dealing with *New Whitwood Tunnels*, and ten acres east of *New Chum No. 4 Tunnel*. It is expected also that the seam will be found to be present in the area of steeply dipping strata in the southern part of portion 272. A promising coal crop was seen in a gully some twelve chains from the western boundary of portion 272. The incomplete section exposed was 4 ft. 8 in. thick with two stone bands each one inch thick and a couple of thinner bands. It could be the Top Coal of the Four Foot Seam. The dip (50 degrees) is too steep for working in the ordinary way but no doubt some suitable method could be devised.

To the rise of No. 3 Shaft Nos. 3 and 4 Seams have been worked to the boundary of the Rylance property but the workings do not appear to extend far into portions 268 and 265. To the dip the workings, particularly on No. 4 Seam, are not extensive and they have not reached portion 269.

The chief handicap facing the management is the frequency of faulting; but in planning the working of the lower seams they can profit by the knowledge gained in working the seam above. Coal reserves in the whole property, including portions 264, 265, 267, 268, 269, 270, 271, 272, are estimated to be approximately four million tons.

Aberdare No. 7 Colliery.—*Aberdare No. 7 Tunnel,* which is under the control of Aberdare Collieries Pty. Ltd., was driven in 1942 near one of Gulland's old New Chum tunnels in portion 265 to work the Top Coal as well as pillars in the Four Foot Seam and to salvage slack which had been stowed in the old bords. As was to be expected they have struck trouble with creeps and falls, but, nevertheless, a good deal of coal is being won.

The main Four Foot Seam has a working section of four feet free of stone bands. The "brushing" band is 17 inches thick and of good quality, but it has not been worked. The Top Coal lies 15 ft. above the "brushing" band and, as usual, the strata between the two sections are stone and coal bands. The worked section of the Top Coal is 5 ft. 6 in. to 6 ft. and this includes three inches of stone in three bands as well as two or three shale partings. The dip here is one in six to the west, but it swings to the south approaching portion 266. *New Chum No. 1 Shaft* lies 12 chains west of the tunnel entrance.

Aberdare No. 5 Colliery (abandoned).—This tunnel was designed to exploit the Top Coal in the extreme west of portion 264. Actually the tunnel entrance, which is on the outcrop of the main Four Foot Seam, is in portion 215 and it must be very close to the Ebbw Vale Fault. The re-opening of the old workings here led to falls and creeps, and it was not long before underground fires caused the abandonment of the tunnel. In addition to these troubles they found that the entire seam was eroded along the course of a small gully, but well below its

led, suggesting perhaps an extension of the nearby Tertiary sediments. The section of the Top Coal is not now visible but the working section of the Four Foot Seam as measured in the tunnel was 3 ft. 3 in., the "brushing" band being 1 ft. 5 in. The tunnel operated from 1939 to 1941.

Rylance No. 3 Colliery.—This property now embraces the western portion of the original *Gulland's New Chum Colliery*, the greater part of the original **Whitwood Colliery (Whitwood No. 1)**, and portions 254 to 257. The New Chum (Four Foot) Seam was originally (in the eighteen seventies) opened up by tunnels driven from the outcrop in portions 264 and 265. Nos. 1 and 2 Shafts were later sunk near the railway siding to facilitate the handling of the coal; and considerably later (about 1890) No. 3 Shaft (the present working shaft) was sunk to work the coal in the central and western parts of portion 266. The New Chum Seam in *Whitwood Colliery* (portions 226, 227, 228, 229, 230, 258, 259) was reached by a vertical shaft and a stone drive tunnel in portion 258. On Mr. Gulland's death in 1902 the property came under the control of Messrs. Hetherington and Rylance. About 1935 the name of the colliery was changed from *New Chum* to *"Rylance No. 3, Dinmore."* It is now owned by Messrs. Rylance Collieries and Brickworks Pty. Ltd. The original Four Foot Seam has been long worked out and for many years the pit has been dependent for its output on the lower banded seams.

The Bluff Seam was worked in a small way from a tunnel near No. 3 Shaft (horse tunnel). It is also partially exposed in a shale quarry near the southern boundary of portion 266, having been thrown up into this position by the south branch of the New Chum Fault. They worked a section in the upper part of the seam but it was excessively banded and the coal is of poor quality. The seam is approximately 30 ft. thick.

No section of the Four Foot Seam is now visible. A. C. Gregory (in Jack and Etheridge (1890)) gives the thickness as 4 ft. 8 in. without a shale band. It lies approximately 190 ft. below the Bluff. A seam believed to be the Top Coal crops out at the surface in portion 256. As seen in an old tunnel here it dips to the north-north-east at an angle of 1 in 2 and is thought to have been dragged up into this position by the Gilliver Fault.

The Top Coal or No. 2 Seam lies 15 to 16 ft. above the main section of the Four Foot Seam, except in the western part of the colliery where it was found to rise steeply while the main Four Foot Seam remained practically horizontal. Where tested by an interior shaft and bore in portion 227 the two seams were at least 70 ft. apart. The coal in this area was worked from a stone tunnel driven through the overlying strata, which are mainly shales, but include a belt of soft sandstones 60 ft. thick approximately 80 ft. above the seam.

An isolated area of Top Coal was worked from No. 4 Shaft in portion 261. The coal was much disturbed by faults. The working section of the Top Coal is reported by the manager to have been seven feet.

The Bergin's Seam, known by the management as No. 5 or the "Underbands," usually lies 18 inches below the Four Foot Seam from which it is separated by alternating shale and coal bands. It must diverge from the Four Foot Seam going south from No. 3 Shaft, for in Whitwood No. 3 Shaft 28 chains away the two seams are 80 ft. apart. A complete section of the seam was not available for examination, but the manager reports that there are altogether 15 ft. of coal and stone bands. On top there are 3 ft. of clean coal, then 3 ft. 6 in. of coal with shale partings, and then 7 ft. of coal with stone bands. The bottom sections, which was visible in the horse tunnel south of No. 3 Shaft, was 7 ft. 4 in. thick and included nine stone bands aggregating 11½ in. in thickness. The "bottoms" and "tops" were worked independently in different parts of the pit, but the complete section of the seam does not appear to have been worked in any part of the mine. Mr. Mathieson reports that the quality of the coal deteriorated toward the eastern boundary of portion 266.

The Bergin's Seam is not completely worked out. Unfortunately its close proximity to the Four Foot Seam, which is sealed off on account of fires, has prevented its further exploitation.

The Striped Bacon (No. 3) Seam is called locally the Seventy Foot or Bergin's Seam in the belief that No. 5 Seam is actually part of the Four Foot Seam. No 5, however, is unquestionably identical with the seam worked in neighbouring collieries as the Bergin's Seam; and even though actual continuity with the Bergin's Seam in the type area at Bundamba has not been definitely established, there seems no reason to doubt the correlation

As exposed near the main haulage dip north of the New Chum Fault the Striped Bacon Seam is 5 ft. 9 in. thick, with five stone bands aggregating 13 inches as well as a couple of penny bands. The section is similar to that in *Whitwood No.* 3, except that the stone bands are thicker. The coal below the yellow band is worked throughout the pit. The quality of the coal is reported to improve on the south side of the fault. No. 3 Seam was not being worked at the time of my visit, but later (in 1946) consequent upon the flooding of the Rob Roy workings, all coal was being drawn from this seam. It lies approximately 70 ft. below the Bergin's Seam.

The lowest seam worked from No. 3 Shaft is the Rob Roy, which has an average thickness of 6 ft. 3 in. or 6 ft. 4 in. and a range from 6 ft. to 7 ft. 3 in. It includes a "badger" 9 to 14 in. thick in about the middle of the section and a number of lenticular stone bands up to three inches thick. The aggregate thickness of the stone bands (including the "badger") is usually 18 inches or more. According to Mr. Mathieson the Striped Bacon and Rob Roy

Seams are 60 ft. apart south of the New Chum Fault, while on the north side the thickness of the intervening measures increases to 110 ft.

A seam considered by Mr. Mathieson to be No. 4 (Rob Roy) crops out on both sides of a north-south ridge immediately south of the Gilliver Fault in portion 255. The thickness of this seam is only 4 ft. 10 in. Trial tunnels were driven on it from both sides of the ridge, but it was found to be weathered throughout. The dip is approximately 4 degrees to the south.

Thirty feet below the Rob Roy Seam there is a seam of inferior coal 2 ft. 4 in. thick. This is exposed in the main haulage dip immediately south of the New Chum Fault and it is reported to have been intersected in No. 3 Shaft on the south side of the "South" Fault a few feet up from the bottom (shaft is 340 ft. deep). A diamond drill-hole commenced in the pavement of the Rob Roy Seam fifty yards from the shaft passed through coal from 34 to 36 ft. It was then continued for nearly 300 ft. without intersecting a workable seam, coaly bands being passed through from 157 ft. to 161 ft.

In the western part of the property an old tunnel driven by Stafford Brothers on Braeside No. 3 Seam, which had been cleaned out and used during the war for the storage of explosives, has recently been prepared for the working of the coal. It will be known as **Rylance No. 5 Colliery.** The workings are reported to be connected with Scarborough's old pit in portion 246. As previously worked the seam was 3 ft. 6 in. thick, but it is now proposed to take down a 6 inch band consisting of stone and "bluey" in order to work six inches of good quality coal above it. The seam dips gently to the north.

A diamond drillhole put down near the tunnel mouth is reported to have passed through Braeside No. 3 Seam between 42 ft. and 47 ft.; from there to 118 ft. odd bands of coal were met with, but there was no sign of Braeside No. 4 Seam. From 146 ft. to the bottom (340 ft.) the strata penetrated were chiefly sandstone, with a few thin bands of shale and fireclay.

A second diamond drillhole in portion 254, commenced at an unknown horizon, passed through a possibly workable coal seam between 93 ft. 6 in. and 98 ft. The section of this seam, as reported by Mr. Mathieson, is:—

	ft.	in.
Good Coal	1	4
Fireclay	0	0½
Good Coal	0	6
"Bluey"	0	4
Coal	0	10
"Bluey"	0	2½
Coal	0	2
Stone	0	0½
Coal	0	4
Stone	0	0½
Coal	0	4

In addition a twelve inch seam was met at 182 ft.; a 3 ft. seam at 193 ft.; and a 2 ft. 6 in. seam containing much shale at 235 ft. 6 in. The bore bottomed in basalt at 287 ft. The reported presence of conglomeratic sandstone in the upper part of the hole suggests that the bore was put down in the Cooneana Stage at a lower horizon than No. 1 Bore.

A third diamond drillhole was put down south-west of No. 2 but its exact position is not known. It passed through a seam of good coal from 108 ft. 9 in. to 111 ft. A second seam of doubtful quality was passed through between 191 ft. 6 in. and 196 ft., while a 4 ft. seam of good coal with one half-inch shale band was met with at 274 ft. Several thin bands of coal or coal and shale mixture were also reported. The hole bottomed in basalt at 328 ft. Assuming the basalt met with in Nos. 2 and 3 Bores to be in the form of a sill and to occupy approximately the same horizon in each bore it would appear that the seams reported are of lenticular habit. This would be quite in keeping with conditions elsewhere in the Cooneana Stage. It might perhaps be worth considering putting down two or three additional shallow bores in the vicinity to prove the extent of the seam met with at 93 ft. 6 in. in No. 2 Bore (which may be identical with the seam at 108 ft. 9 in. in No. 3 Bore).

The Rylance property is badly affected by faulting. The Gilliver Fault which hades steeply to the north throws out all the worked seams in the south-western half of the property. If the seam already described as cropping out near the top of a ridge in portion 255 is, as Mr. Mathieson believes, No. 4, the throw on the Gilliver Fault must be 350 to 400 ft. If the seam is a lower one the throw will be even greater.

The New Chum Fault is believed to branch from Gilliver's Fault somewhere in the neighbourhood of portion 257. It is reported to hade to the north at an angle of 45 degrees and to throw down the strata to the north by 115 ft. Three or four chains east of No. 3 Shaft the New Chum Fault is joined by a fault (the South Fault) coming from the south, and apparently linking up with Gilliver's. It hades to the south-west and throws down the strata in the direction of the hade by 90 ft. East of the junction the downthrow is 205 ft., or the sum of the two downthrows.

Several comparatively minor east-west faults have been met with in the workings north of the New Chum Fault. In the Rob Roy Seam workings three such faults, all of which grow rapidly going west, have been met with. They have caused much inconvenience in mining.

The general dip in *Rylance No. 3 Colliery* is to the south but the plans show some folding of the coal seams. Dips, however, are not steep and the folds are really in the nature of undulations. Steep dips and broken strata in portions 254 and 255 suggest rather heavy east-west faulting there, with a probable upthrow to the south.

In the northern part of the property the coal measures have been eroded to a depth of at least 350 ft. below the surface and replaced by Tertiary sediments, and this has had a serious effect on the coal resources. The Four Foot and Bergin's Seams have been extensively eroded, the estimated loss from this cause being three-quarters-of-a-million tons of coal. The lower seams are not known to be affected by erosion.

The manager estimates that reserves of coal in the property are approximately 500,000 tons, which, at the present rate of output, will be exhausted in nine years. The lower seams of the Cooneana Stage that have been located in the western part of the property are small and apparently lenticular, and cannot greatly affect the life of the mine. The upper seams of the Tivoli Stage are believed to lie no deeper than 1,000 ft. below the surface in this western area and the deepening of one of the existing diamond drillholes to that depth is suggested as a means of testing them.

Dinmore Colliery (abandoned).—This property lies on the northern side of the railway at Ebbw Vale. The colliery was opened up about 1893 by the New Swanbank Company, but the New Chum Seam was found to be of limited extent and was quickly worked out. Subsequently a lower seam was worked to a small extent. The colliery seems to have been abandoned since 1912, though attempts were made to work it in 1915 and again in 1923.

The New Chum Seam does not crop out at the surface, having been eroded to a shallow depth and replaced by Tertiary sediments. A shaft sunk near the railway reached the New Chum Seam at a depth of 215 ft. (one report says 250 ft.). Immediately north of the shaft they encountered an east-west fault hading south, which threw the coal up 100 ft. A second fault was met with six chains north of and parallel with the big fault. This fault, according to Cameron (1899), displaced the seam by 40 ft. in the eastern workings but died out to the west. So far as can be learned, neither the Top Coal nor the Bergin's Seam was worked. The identity of the lower seam will be discussed in the section which follows.

Amberley No. 3 Colliery.—In 1942 a small party of miners drove a tunnel to the New Chum Seam just beyond the eastern extremity of the old *Dinmore* workings. The tunnel mouth is immediately north of the railway and about four chains from the eastern boundary of portion 140.

The tunnel passed through twenty feet of soft Tertiary sandstones, then twenty feet of Ipswich shales, and then the Four Foot Seam, which was found to be destroyed by weathering. Eighteen inches under the Four Foot Seam the tunnel entered the Bergin's Seam, the top section of which was worked until it became evident that they were under the old *Dinmore* workings, and they were obliged to withdraw. They then continued the tunnel through the underlying strata and eventually intersected a workable seam 150 yards from the tunnel mouth. The pavement of this seam is 160 ft. below the worked section of the Bergin's Seam. Fourteen feet below the Bergin's Seam the tunnel passed through a seam of coal 2 ft. thick, and 75 ft. below the Bergin's Seam a second seam 3 ft. 5 in. thick was met with. This succession cannot be satisfactorily correlated with that in the neighbouring collieries. The 2 ft. seam near the Bergin's Seam has not been reported elsewhere, while the 3 ft. 5 in. seam, though not much below the normal position of the Striped Bacon Seam, bears no resemblance to the latter as exposed in *Rylance No.* 3 *Colliery* or elsewhere.

The bottom seam, which is the lower seam of the old *Dinmore Colliery,* is 4 ft. 9 in. thick. It has a somewhat banded section 2 ft. 7 in. from the floor and a lenticular band of ironstone 18 inches from the floor. In these two respects it resembles the Rob Roy Seam as worked in *Rylance No.* 3 *Colliery* but it is very much thinner than the latter, 18 inches of the top coal being missing. Overlying the worked section there are 22 ft. of grey shale carrying a number of dark bands which in some respects resemble oil shale. This substance has a greasy streak and a deep chocolate to black powder. A sample of the thickest of these beds (12 inches) had an ash content of 73·7 per cent. and yielded oil at the rate of 8 gallons per ton on destructive distillation. These black shale beds are remarkable for the exquisite preservation of the fossils they contain.

The workings on the lower seam of *Dinmore Colliery* lie north of *Amberley No.* 3 workings and are separated therefrom by a normal fault striking east-north-east–west-south-west and hading to south-south-east at 55 degrees. A connection has been established with the old workings by means of an interior shaft for ventilation purposes. An examination of the seam in the old workings leaves no doubt that it is identical with that being worked in the new pit, though the section is rather thinner. The coal is thrown up to the north-north-west by approximately 70 ft.

Reserves of coal between the two main faults are estimated at 110,000 tons. The coal appears to be decreasing in thickness going north, and it cannot be counted on to continue far in this direction as a workable seam. Additional reserves north of the northerly fault (including pillars in old workings) may amount to 70,000 tons. No lower seams are known to occur in the property; but in view of the uncertain identity of the seam now being worked it would be worth while putting down a diamond drillhole, say three or four chains north-westerly from the tunnel mouth, to ascertain if any workable coal exists below it.

Whitwood No. 2 Colliery (abandoned).—The shaft, which is situated near the south-eastern corner of portion 141, Goodna, was sunk about the year 1902 to work the New Chum Seam north of the railway. The depth of the shaft is shown on Mr. Cameron's 1907 map as 100 ft. but the eight-chain

MS. map, prepared much later, gives the depth as 290 ft. The latter is the more likely figure as the shaft is on the downthrow side of the big fault in the *Dinmore Colliery*.

There is no written record of this colliery but the old plan (which is without annotation) shows the workings terminating in the south against a fault (believed to be Gilliver's), while in the north they abut against either a fault or a washout, probably the latter, as a bore ten chains north of the shaft is reported to have gone down 400 ft. in Tertiary sands. The workings did not reach the western boundary of portion 141, but the reason for this is not known.

The Four Foot Seam is worked out, but there is no evidence that the lower seams have been tested. The lower seam of the *Dinmore Colliery* is estimated to be 460 ft. below the surface at the shaft; as, however, no more than about thirty acres of coal can be counted on (even assuming that the seam is workable) there is not much encouragement to deepen the shaft to exploit it. In any case it would be desirable to precede any contemplated mining development by diamond drilling.

Ebbw Vale Colliery (abandoned).—The colliery is reported to have been opened up about the year 1880. The shaft was sunk near the western boundary of portion 262 to work the New Chum Seam, but unfortunately for the proprietors the site selected was very near the then unsuspected Ebbw Vale Fault which throws out the New Chum Seam altogether. The fault was passed through about 60 ft. down, and below that they encountered several seams of coal, two of which were worked a little. Generally, however, the coal was inferior, and the shaft was soon abandoned. A second shaft was then sunk clear of the fault and from it the small area of New Chum coal remaining in the south-western corner of the property was worked. Subsequently the company arranged with the owners of the *New Chum Colliery* to work the coal in portion 261. No. 1 Shaft was re-opened and the New Chum Seam was reached by driving through the fault. The date of the abandonment of the pit has not been ascertained, but it must have been in the early years of the century.

An old plan, accompanied by vertical sections, which was made available by the kindness of Mr. G Mathieson, manager of *Rylance No. 3 Colliery*, shows five coal seams in No. 1 Shaft varying in thickness from seven inches to five feet. The first seam was 70 ft. from the surface just under the Ebbw Vale Fault. The thickness of this seam is given by R. D. Graham, Authorised Surveyor (1898), as 4 ft. 11 in. There was a 3 ft. banded seam at 120 ft. According to Graham's section a seam 3 ft. 10 in. thick was met with at 285 ft., whild the bottom seam at 307 ft. was 4 ft. thick. A drive was put in to the south at 180 ft., apparently in stone as there is no reference to any coal in it.

These seams cannot be correlated with the lower seams worked in *Rylance No. 3 Colliery*, and it is believed that they lie somewhere in the upper part of the Cooneana Stage. If this is the case the throw on the Ebbw Vale Fault in the vicinity of *Ebbw Vale Colliery* must be 450 ft. or more.

Certain of the shale beds on the north-eastern side of the Ebbw Vale Fault have been found suitable for pottery manufacture and a number of tunnels have been driven to exploit them. Skertchly (1899) described the main clay occurrence as fault filling with the original iron content leached out. A pottery has been established here for over fifty years. Since the exhaustion of the New Chum Seam coal supplies have been obtained from neighbouring pits. As the coal required for pottery purposes need not be of very high quality the exploitation of the seam intersected at 70 ft. in the shaft merits consideration.

Prospecting North of Dinmore.—Natural exposures of Ipswich Coal Measures are infrequent in the area between Dinmore and the Bremer River, being largely obscured by a thin covering of Tertiary sediments or river alluvium. Prospecting has been carried on sporadically with but little success.

The Ebbw Vale Fault appears to die out approaching the Bremer River, as beyond the river, where exposures are plentiful, there is no sign of any major disturbance. The only evidence of the existence of a fault is afforded by relatively high dips (30 degrees) in a quarry in the middle of portion 139, Goodna. Otherwise, with one or two exceptions, dips are slight (1 in 6 or less).

The upper part of the Cooneana Stage here seems almost devoid of coal. No seams were reported in an old trial shaft a-quarter-of-a-mile north of Amberley No. 3 Tunnel, while in Martin Millar's Shaft, 15 chains further north, the first coal was met with 260 ft. from the surface.

In portions 32 and 33 a considerable amount of prospecting has been done in recent years by Mr. Kathage of Westphalen Colliery (Rosewood). Four coal seams were located, but none has yet been shown to be workable. The uppermost seam is reported to be 25 ft. thick. As partially exposed in a tunnel in portion 33 registered as **Westphalen No. 2 Colliery** this seam consists of alternating bands of coal and stone, the proportion of coal to stone being roughly 2 to 1. The quality of the coal is extremely variable but the bulk of it is too poor to work. The second seam is reported to be 30 ft. below the big seam and to be 3 ft. 4 in. thick. The third seam where intersected at a depth of 90 ft. in a trial shaft was completely coked. Its thickness was reported to be approximately 7 ft. A sill was met with in driving the dip from the shaft bottom. Mr. Kathage believed that this seam would be workable if it could be located away from trouble. A seam 9 ft. thick located in a trial shaft 14 chains to the north-east is possibly identical with the coked seam. An examination of the upper three feet

showed the coal to be of inferior quality; Mr. Kathage considered the seam unworkable. The lowest seam was located in a trial shaft 20 chains north-west of the tunnel. It is reported to consist of a succession of thin bands of coal and stone. A sample of the coal brought up from the shaft yielded only 7 per cent. ash. This seam is believed to be somewhere about the horizon of the Garden Seam.

In about the centre of portion 31 there are signs of an old tunnel (or shaft) from which coal is reported to have been worked to fire some brick kilns formerly situated hereabouts. Small fragments of coal are still lying about on the surface. There is a second old excavation (also accompanied by coal fragments) which may have been an air shaft. It is impossible to say if this seam is identical with the upper or any of the seams prospected by Kathage.

Two seams were opened up many years ago in portion 30. The old tunnels were located but nothing could be seen of the seams themselves. Unless a major fault intervenes these must be on a higher horizon than Kathage's seams. The coal is said to have been worked to a small extent in *Ellis and Glassey's Tunnel* (see map).

A large area of country north of Dinmore has been proved to be coal-bearing, but the relatively slight amount of prospecting done to date has failed to bring to light a workable seam. Further efforts in this direction are considered to be well worth while in view of the large area available should a good seam be found.

CHAPTER 16.

BETWEEN DINMORE AND GOODNA.

Belmont Group of Collieries.—The original Belmont Tunnel was opened up in 1901 in the Verrall Estate on the right bank of Six Mile Creek. The first of the later group of *Belmont* tunnels was opened in the late nineteen twenties near the western boundary of portion 216, Goodna, to the west of Six Mile Creek. This was called **Belmont Extended** and is generally considered to have been on the Bergin's Seam. It was abandoned in 1934, and in the same year **Belmont No. 2 Tunnel** was opened up on a lower seam east of Belmont Extended Tunnel. The **Happy Valley Colliery,** supposedly on the Bluff Seam, had in the meantime been opened up near the northern boundary of portion 217. In 1938, the *Happy Valley* pit was abandoned and *Belmont No.* 3, also in portion 217, was opened. The latter is on the Four Foot Seam and has operated continuously up to the present time.

Belmont No. 3 Tunnel is exploiting a narrow belt of Four Foot coal between two roughly east-west faults. Where first opened up the main section of the seam was represented by only a few inches of coal, and operations were restricted to the Top Coal 14 ft. above. Lower down the main Four Foot Seam was found to have a workable thickness and both sections are now being exploited. In the main seam there are three feet of coal under the two white bands and 13 inches in the "brushing" band, which is being worked, the total thickness being 4 ft. 6 in. The Top Coal varies in thickness from 4 ft. 9 in. to 5 ft. 3 in. It carries three or four lenticular stone bands totalling about four inches. The coal carries many dull bands indicating a high content of mineral matter.

As is to be expected in such a situation faulting is prevalent, the dislocations being mostly of the order of 3 to 6 ft. The largest fault (except the two east-west bounding faults) is that which brings down the Top Coal level with the main seam, the throw being 14 ft. This is a case where a fault is not an unmitigated evil, for it showed the main seam to be workable and brought it into a position where it could be exploited without any stone work. The southern fault hades to the north at an angle of 55 degrees or thereabouts and throws the coal down to the north by 70 ft. at the outcrop. The northern fault is supposed to hade to the south at an angle of 1 in 1 and to throw down the coal to the south by 70 ft. When, however, the plan of the *Happy Valley Colliery* is superimposed on that of No. 3 Colliery it is seen that the workings in the former actually overlap the No. 3 workings. It is plain, therefore, that the main fault between the two pits hades to the north and that the southerly-hading fault seen in the faces of No. 3 Colliery is not the main fault. If the seam worked in *Happy Valley Colliery* is the Bluff Seam as claimed (the seam is not now visible) the downthrow to the north is probably not great, as the Four Foot and Bluff Seams in this area are usually no more than 100 to 120 ft. apart.

Nothing can now be seen of *Belmont No.* 2 or *Belmont Extended Colliery.* The southern workings in these pits terminated against an east-west fault which is estimated to throw the seams down to the south by approximately 200 ft. The seams worked are reported to be respectively the Striped Bacon and Bergin's. The former is stated to have been 4 ft. 6 in. thick and very banded. I could learn nothing of the seam worked in *Belmont Extended.* The Rob Roy Seam has not yet been prospected in this property. The plans show both seams bent into an anticline pitching north-west to west-north-west. Dips, however, are very slight and the structure does not appear to be of any great significance. The Ebbw Vale Fault, had it continued on its course, should have been seen in the northern workings of *Belmont No.* 2 *Colliery.* Not only was it not seen here but there is no indication of it in the Verrall Estate to the south-east. As to which, if any, of the east-west faults is the New Chum Fault the evidence at the moment is inconclusive. The most probable seems to be that separating the *Happy Valley* and *Belmont No.* 3 *Collieries,* but the southern fault in Belmont No. 3 is also a possibility. Much more will be known when the Belmont workings reach the western boundary and when the lower seams are worked in portions 268 and 269. In any case the fault seems to be petering out going east.

Assuming that the Rob Roy Seam is workable, considerable reserves of coal are believed to underlie portion 217, as none of the lower seams has yet been exploited and the Four Foot has not been worked in the faulted block between *Belmont No.* 3 and *Belmont Extended.* The excessive faulting, however, will block large-scale operations and a good deal of dead work will be involved in reaching the lower seams. Nevertheless, making liberal allowance for wastage through faulting, reserves are estimated to approach half a million tons.

Noblevale No. 2 Colliery (abandoned).—This pit is in portion 218, Goodna, immediately south of the southern fault in *Belmont No.* 3. It was commenced about the year 1910 and was finally abandoned in 1929. Seams worked were the Four Foot, Bergin's, and Striped Bacon.

The Four Foot Seam comes to the surface along an east-west line in portion 218, though, except at the entrances to the old tunnels, the crop is not exposed. The Four Foot Sandstone, however, may be traced from the loopline almost to the western boundary of the portion, where it swings to the north-west. The original tunnel was driven near the eastern boundary of portion 218. It met a fault a short distance after crossing Six Mile Creek and then stopped. The coal section decreased to 2 ft. 2 in. in the eastern workings. Subsequently two tunnels

were opened up further west to work the coal in the southern part of portion 218. The main seam, still visible in one of the old tunnels, has a similar section to that in *Belmont No.* 3. The Top Coal does not appear to have been worked. The dip at the tunnel mouth is 15 degrees to the south. To the west the seam got into disturbed country while to the east, as already mentioned, the coal pinched.

The Bergin's Seam does not outcrop in portion 218, being cut off near the surface by the same fault that truncates the Four Foot Seam in *Belmont No.* 3. It was reached by a vertical shaft and by a tunnel driven through the overlying strata. The air shaft, which was started behind the outcrop of the Four Foot Seam, passed through 55 ft. of solid sandstone and then 24 ft. of coal and stone bands before reaching the Bergin's Seam, which is thus more than 80 ft. below the former. The worked section of the seam is 3 ft. 10 in. to 4 ft. 2 in. thick including one permanent stone band one inch thick and a number of thin lenticular bands. In the west the workings did not get beyond the troubled country met with in the upper workings. To the east they crossed Six Mile Creek and worked the seam over an area of seven acres in the Verrall Estate (portion 285) below Verrall's old workings. The Striped Bacon Seam was worked to a small extent from the shaft. Cameron (1914c) reports that the worked section of the seam was 3 ft. 1 in., including a five inch band of stone and coal, with an unspecified thickness of coal and stone bands below. This seam lies 90 ft. perpendicularly below the Bergin's.

Whitwood No. 4 Colliery (abandoned).—The property lies to the south of *Noblevale No.* 2 and the workings are all included in portions 219 and 220. So far as can be gathered the colliery seems to have operated from about 1909 to 1918. The main shaft is near the northern boundary of portion 220 and the air shaft is just across the boundary in portion 219. I am informed by Mr. J. Conway, Superintendent of Aberdare Collieries Pty. Ltd., that the Four Foot Seam was missed owing to faulting, the Bergin's Seam being intersected at 435 ft. The Four Foot Seam was reached at this level by driving in stone through the fault. The Bergin's Seam was worked to a limited extent south of the shaft. So far as the plan shows no work was done on the Four Foot Seam south of the shaft, nor was the Bergin's Seam exploited in portion 219. There is no record of the thickness or quality of the coal in either of the worked seams.

The reason for the closure of the pit is not apparent. The Four Foot Seam is presumed to have pinched going east, as it does near the outcrop, while to the west they came upon a fault (roughly in line with the Whitwood Fault) that reportedly threw the coal up 30 ft. to the south-west. No coal appears to have been worked beyond the fault.

Reserves of coal in portions 219, 220, and 221 may be considerable, but as practically nothing is known of this isolated colliery no estimate of tonnages has been attempted.

The Verrall Estate (portion 285, Goodna).—Mr. Cameron's 1899 map shows a tunnel on "Verrall's" Seam on the bank of Six Mile Creek, so that mining activities in this property go back well over forty-five years. Early in the present century Mr. A. Bennett drove a tunnel (the original *Belmont Tunnel*) on the outcrop of a seam about a-quarter-of-a-mile north of Verrall's Tunnel. It is reported that Bennett later reopened Verrall's Tunnel. The property was taken over by H. G. Noble Ltd. a few years later, and the Bergin's Seam was worked by a tunnel (*Noblevale No.* 2) driven into the estate across Six Mile Creek. Noblevale Tunnel was not abandoned until 1929, though the workings in portion 285 had received no attention for some years. In 1939 J. Gilliat opened a tunnel (position doubtful) which he called East Belmont, and in the following year he began a second tunnel known now as *New Aberdare East No.* 2. The New Aberdare Company took over the property a year or two later and re-named it **New Aberdare East.** A washing plant was installed in 1940.

The Four Foot Seam in No. 4 Tunnel has a maximum thickness of 2 ft. 6 in. and it is often reduced by erosion to a few inches. The Top Coal appears to be absent. Two prospecting tunnels driven on the Four Foot seam further east have shown it pinching out in that direction. In No. 2 Tunnel, the mouth of which lies about a chain east of No. 3, the Four Foot Seam was missing for three chains. It showed up first in the roof, proving that its absence was not in this case due to erosion but apparently to non-deposition. The thickness of the coal increases to three feet, but its quality is very inferior. The seam was worked to a small extent in No. 4 Tunnel.

The Bergin's Seam is being worked in No. 3 Tunnel. The tunnel mouth, which was commenced in stone, passed through a fault thirty yards from the entrance, which brought the seam level with the tunnel. The fault hades to the north-north-east at 1 in 1 and throws the coal down in that direction by 100 ft. or more. Bennett's old tunnel, usually called the "Wet Tunnel," commences thirty yards west of No. 3 and connection has been made with it for ventilation purposes. As well as driving the dip they are splitting pillars in the old *Noblevale No.* 2 workings. The worked section varies from 3 ft. 11 in. to 4 ft. 4 in. The coal is hard and dull bands are frequent, indicating a high mineral matter content. The seam dips at 15 degrees to the south or a little east of south.

Apart from the fault already referred to which terminates the workings to the north-north-east, no trouble has been encountered. It was expected that the fault which stopped *Noblevale Tunnel* would have been met with in the dip, but they have now gone several chains beyond the point where the fault was expected without seeing any sign of it.

Bennett's old tunnel on the Bergin's Seam is 12¼ chains north of No. 3, the outcrop having been brought to this position by two roughly parallel

faults. On the east side of the tunnel it is reported that they met a "coke fault" (dyke), while in the tunnel itself there was a fault hading north-west and throwing the coal down 32 ft. in that direction.

The Bergin's Seam has been prospected ahead of No. 1 Tunnel (9 chains east of Bennett's Tunnel) where it was 90 ft. above the Striped Bacon Seam. The coal was very inferior and was considered unworkable. The coal and stone bands usually found overlying the Bergin's Seam in this area were missing, but 20 ft. above the seam there is a second seam which was also prospected by a tunnel. Only 18 inches to 2 feet of coal are to be seen in the tunnel on the top seam, the balance having been replaced by a sill which has coked the coal for a few inches from the contact. In places the sill pinches and the seam may be as much as 3 ft. or more thick. Where this happens the upper section of the coal is completely coked, and some interesting examples of radiating columnar jointing are seen. The Bergin's Seam has not been identified east of these tunnels.

New Aberdare East No. 1 Tunnel, which is now abandoned, was driven on the Striped Bacon Seam which had a working section of 5 ft. 3 in., including ten inches of stone in six bands. Over this section there are nine feet of stone and coal bands. The coal deteriorated going east, but showed no change in depth. The level course of the coal runs north 15 degrees east. The pit is reported to have been abandoned on account of a serious creep. Some fifteen chains east of No. 1 Tunnel the Striped Bacon Seam as exposed in a trial shaft shows 12 ft. 10 in. of coal and stone bands without a workable section.

The Rob Roy Seam has not been worked in the Verrall Estate. It has been prospected by a tunnel driven on the outcrop east of No. 1 Tunnel with disappointing results. In the tunnel face the seam is 4 ft. 7 in. thick but it includes 1 ft. 11 in. of stone.

In 1944 the New Aberdare Co. put down two diamond drillholes in portion 285 to prospect for the Four Foot Seam south of the existing workings on that seam. The drilling demonstrated that the Four Foot seam ceases to exist as a workable seam south and east of the faces of *Noblevale No.* 2 workings. No. 1 bore also showed that the Bergin's Seam becomes unworkable to the dip of *Noblevale No.* 2 workings.

In the southern part of the estate silicious sandstones, which are believed to lie somewhere above the Bluff Seam, outcrop prominently and are bent into a well defined dome structure. A trial shaft (now collapsed) in about the centre of the dome must have passed through a considerable thickness of coaly shale and inferior coal, for this material constitutes a big proportion of the dump. It may possibly be the Bluff Seam.

Country North and North-West of Verrall Estate. —In the area between the Verrall Estate and the Brisbane-Ipswich railway the strata are bent into an open anticlinal fold pitching about south-south-west. The beds belong to the Cooneana Stage and are predominantly sandstones. A good deal of prospecting has been done from time to time and a number of seams have been located. Like most of the coal in the Cooneana Stage, however, they have proved not quite good enough to work.

Most prospecting has been carried out in portions 214 and 215, where two seams have been traced in a north and south direction for nearly half-a-mile, while a third seam has been exposed at one or two points. The top seam is not fully exposed, but Mr. J. Conway of Aberdare Collieries Pty. Ltd. (the prospecting company) reports that there are 20 ft. of coal and stone bands without a workable section. The second seam which is about 40 ft. below the top seam is in two sections separated by three feet of sandy shale. The top section which is about 3 ft. thick has not been opened up. The lower section is 3 ft. and carries a white stone band two inches thick six inches from the roof. The coal appears to be of good quality (a sample of somewhat weathered coal from the outcrop yielded 10·4 per cent. ash). The third seam was prospected by costeans in a gully below the outcrop of the second seam. Owing to the collapse of the excavations the seam is not adequately exposed but it appears to be mostly coaly shale with thin bands of coal. Two prospecting shafts sunk through the massive sandstone underlying the third seam have entered beds of a curious kind of sooty coal. The beds themselves could not be inspected but the material brought up from them has fallen entirely to a fine sooty powder. The seams prospected in portions 214 and 215 are probably identical with the lower seams located in *Ebbw Vale No.* 1 *Shaft.*

East of portions 214 and 215 a number of seams believed to occupy approximately the same stratigraphical position as those in the portions referred to re-appear as the result of a reversal of dip from west to south-east. The lowest of these seams could not be seen; it was reported to have occurred at a depth of 40 ft. in a shaft (now filled) sunk in the bed of Six Mile Creek in portion 211. It has not been seen to crop out anywhere in the locality. A second seam, some 50 feet above that reported in the shaft, outcrops on the left bank of Six Mile Creek in portion 211. A trial tunnel recently driven on it by the Bonnie Dundee Company, and registered as **Bonnie Dundee No. 4 Tunnel,** shows the seam to be 4 ft. 9 in. thick and to include 5½ in. of stone in three bands. The quality, so far as it is possible to judge it from the slightly weathered coal showing in the face of the tunnel, is rather inferior *in toto* though it includes some nice looking bands. A sample from the face showed 27 per cent. ash. The strata about here dip to the south-east at angles ranging from 1 in 8 to 1 in 5. A seam between 4 and 5 ft. thick is to be seen immediately under the soil in a trial shaft about six chains east of the tunnel, while another seam is said to have been met with at a depth of 25 ft. in the same shaft. What I take to be one of the seams met with in the shaft crops out in portion 167, where a trial tunnel has been driven on

it. The tunnel has fallen in but, judging by the material in the dump, the coal was not of good quality, being mostly of a stony nature.

Towards the eastern boundary of portion 211 there is a zone of steeply dipping strata about four chains wide, evidently the result of a fault or monoclinal fold, throwing down the strata to the east. The same disturbance shows up where the Brisbane road crosses the loop-line and also in a cutting in the loop-line immediately north of the road. There is no means of estimating the dislocation caused by this disturbance.

A seam of coal has been prospected by a tunnel (now collapsed), and in recent years by a shaft, between Six Mile Creek and the loop-line close to the western boundary of portion 170. This is in the line of the disturbance seen in portion 211 and further north, but the strata in the shaft are reported to dip at a low angle (1 in 8) and to show no sign of faulting. As the shaft is only twelve chains from the exposures of steeply dipping strata in portion 211 the disturbance may be dying out rapidly in this direction and the dislocation of the strata may not be so great as the wide zone of steep dips suggests. The seam in the shaft is reported to be five feet thick. The coal is described as "stony." The geological mapping suggests that it may be the Rob Roy Seam. Kerwick and Leslie's Shaft, which is about 100 yards to the south-east, is reported by Mr. Conway to be in coal and shale bands from 107 ft. to 121 ft.; then follows inferior coal, 1 ft. 9 in.; soft shale, 1 ft. 10 in.; and inferior coal to the bottom (about 125 ft.). The section above 107 ft. is not known as the shaft is timbered from there to the surface. On the information available the coal in the two shafts cannot be correlated.

Railway at Riverview.—The railway cutting immediately east of Riverview station has exposed two coal seams separated by 20 ft. of shale. The upper seam is 3 ft. thick and carries several stone bands. The lower seam is 7 ft. thick, but included in this there are three bands of stone three to five inches thick and a number of smaller bands. The seams dip at 1 in 1 to the south-east, evidently under the influence of a fault hading in that direction. An air-raid trench on the station platform exposed a seam of coal 3 ft. thick dipping west-north-west at 10 degrees. Ten chains east of the station some prospecting has been done between the railway and the Brisbane road. There is an old collapsed shaft where coal and coaly shale show in the dump and nearby a tunnel driven on a grade of 1 in 3 through massive sandstone. It is not known if the tunnel reached the coal as it is blocked twenty-five yards from the entrance, and the dump has been removed. Near the western boundary of portion 132 a fault hading west-north-west is seen in the old railway cutting. The various seams exposed hereabouts are assumed to lie within the Cooneana Stage.

Old Redbank Colliery (abandoned).—The late Wm. Fryar (1900) records that *Redbank* was the first colliery to be worked in the district, having been opened in 1846 to supply the needs of the small steamship "Experiment" plying between Brisbane and Ipswich. After two years it was abandoned in favour of the *Moggill Pit.* It was re-opened in 1857 but again abandoned prior to 1876. There must have been a third period of activity for an accident was reported to have taken place in the pit in 1888. The date of its final abandonment is not known. According to Gregory (1876) the thickness of the seam varied between 3 ft. and 6 ft. and there were several shale bands. The dip was "a little to the south."

None of the shafts could be found but the tunnel in the river bank, though blocked at the mouth, was located without difficulty. There are some six feet of shale overlying the seam and above the shale coarse, massive sandstone. The dip of the strata on the river bank in portions 128, 129, and 106 fluctuates considerably, but there is a resultant slight dip to the north. This seam evidently underlies that worked in the new Redbank pit.

New Redbank Colliery (abandoned).—Workable coal having been located in a prospecting shaft in portion 52, Goodna, in 1913 a main shaft was commenced and by the end of 1914 the pit was ready to start producing coal. The colliery worked steadily until 1932, when it was abandoned.

Both shafts have fallen in, and there is no official record of the colliery except mine plans which are insufficiently annotated. There is, however, in the files of the Geological Survey a detailed section of the coal prepared by Mr. J. H. Reid and also a sketch plan showing the line of erosion of the top seam. Mr. Reid's section shows the coal-bearing section to be 50 ft. thick, and to include 21 ft. of workable coal in three seams. The top section, or "top seam" as it was called, is 8 ft. 10 in. thick with three stone bands totalling seven to nine inches. The "middle seam" which is 6 ft. 10 in. thick, includes two stone bands, one of which is 6 in. thick and the other 1 in. The "bottom seam" is 5 ft. 8 in. thick and carries only one two-inch stone band. Underlying the "top seam" there are twenty inches of shale while between the middle and bottom sections there is a lens of sandstone ranging in thickness from two inches to twenty feet. The balance of the section comprises coal and stone bands. Mr. Reid shows the "top seam" to be eroded along a north-west–south-east line passing 1½ chains south-west of the main shaft. The mine plan shows a small area of worked coal north of the shaft, and it is evident that the seam was not completely eroded in this particular section. The workings on all sections of the seam come to an end against a fault striking north-west–south-east which runs six or seven chains south-west of the shaft. The coal is said to be thrown up to the south-west along the fault by 70 to 75 ft. The plans show five other (presumably minor) faults. One of them is marked "overlap" and would appear to be a thrust fault. The coal is reported to dip gently to the south.

Considering the big thickness of coal in the three worked sections the workings are not extensive (35 to 40 acres). Presumably the excessive faulting and the resulting increased costs of working were at least factors contributing to the abandonment of the pit. The area south-west of the big fault merits testing with a diamond drill.

The outcrop of this large seam has not been definitely identified. The only large crop seen hereabouts is that exposed in the cutting in the loop-line immediately north of the Brisbane road, the whole of which is excessively banded. A prospecting shaft is reported to have been sunk to a depth of 200 ft. in portion 126, 28 chains north of the main shaft, without penetrating any coal. Whether the seam is eroded here or, by steepening of the dip, has come to the surface south of the shaft is not known. No seam comparable in section with the seam in Redbank Colliery has been seen anywhere on the field, but the geological mapping suggests that its horizon is somewhere about the base of the Rhondda Shales.

Erskine and Cribb's Bore (Portion 59, Goodna).—A diamond drillhole was put down in portion 59, Goodna, by Messrs. Erskine and Cribb in 1911 to a depth of 1,255 ft. without locating a workable seam. Commenced in the lower beds of the Bundamba Series, this hole must have penetrated the Ipswich Series at least as far as the base of the Rhondda Shales; the absence of a workable seam emphasises the deterioration of the coals of the Blackstone Stage going east from the main productive area.

Goodna Colliery (abandoned).—This pit was opened up about 1868. Gregory (1876) reports that the seam cropped out less than a mile from the bank of the Brisbane River and was originally worked from a tunnel driven on the crop, but later from a shaft 90 ft. deep. A map accompanying the Annual Report of the Mines Department for 1904 shows two shafts, one on each side of the railway. Neither of the shafts could be located but the old tunnel and railway siding are still plainly to be seen immediately south of the Brisbane road between Goodna and Redbank. The date of abandonment of the pit is unknown. The seam is reported to be 4½ ft. thick and to dip south at 3 to 5 degrees. No detailed study of the geology of the country between Redbank and Goodna has been made, but reconnaissance mapping suggests that the Goodna Seam is on much the same horizon as the seam in the new *Redbank Colliery*.

CHAPTER 17.

MOGGILL DISTRICT.

Riverside Nos. 1 and 3 Collieries.—Riverside No. 1 Seam is reported to have been located about 1924 on the western side of the Moggill pocket and a tunnel (No. 1) was driven in portion 93, Moggill. Subsequently No. 2 Seam was located and No. 2 Tunnel was driven in portion 103. No. 1 Colliery was abandoned in 1931. No. 2 Seam, however, having proved rather disappointing, the tunnel was abandoned and a second tunnel (No. 3) was driven on No. 1 Seam in portion 94.

No. 3 Tunnel is driven through 35 ft. of clay, sand, and gravel (high-level river alluvium) to reach the coal. To begin with the seam dips south-south-east at 3 to 4 degrees. About 20 chains from the entrance it becomes horizontal and beyond that again the dip is reversed and the "dip" becomes a "rise." To the right and to the left of the tunnel the seam dips towards the tunnel, thus forming a closed basin-shaped structure. The coal was found to be eroded all around the rim of the basin, and it has been worked to its limits in every direction. Pillars are now being extracted, and in a matter of a few years the pit will be completely exhausted.

The seam has an average thickness of 5 ft. 7 in. It is divided into two roughly equal sections by a "badger" some twelve inches thick, and, in addition, there are usually five or six stone bands all less than one inch thick. The roof is banded shale which is reported to be 20 ft. thick and to be overlain by a sandstone with a red stain (air shaft section). It is not clear whether this is the original Redbank Seam or whether it is on a lower horizon. On the whole I am inclined to believe that it underlies the Redbank Seam.

Riverside No. 2 Colliery.—When it became obvious that No. 3 pit was approaching exhaustion the proprietors decided to re-open No. 2 tunnel. The tunnel is driven on a grade of 1 in 4 through alluvium (12 ft.) and sandstone (70 ft.), which becomes very coarse at the base. The full thickness of the seam is 18 ft. but the section at present being worked is only 2 ft. 9 in. thick. Between the worked section and the pebbly sandstone roof there are 5 ft. 9 in. of coal and stone bands of which about two feet are brushed in the haulage roads. A lower section, separated from the "tops" by 5 ft. 6 in. of coal and shale bands, and having a thickness of 4 ft. 3 in., has been worked to a slight extent. This section carries a "badger" almost a foot thick as well as two smaller stone bands, and the coal is rather inferior. The main worked section carries two or three penny bands and in places a lenticular band of "bluey." The coal could be considerably improved by the use of a washing plant. Assuming that the coal does not deteriorate to the dip and that only the "tops" are worked, possible reserves are estimated to be approximately half-a-million tons.

No. 3 Seam, which is 13 ft. 5 in. thick, was located in a prospecting shaft north of No. 2 Tunnel at a depth of 59 ft. As reported by the proprietors the seam carries a large number of stone bands, and, except for the bottom three feet in which there are only four stone bands totalling 4½ inches, is unworkable.

Prior's Pit (abandoned).—This is one of the very early pits, believed to have been opened in the middle eighteen-fifties. It was taken up by a syndicate in 1913 after having been abandoned for some fifty years. The syndicate went to a good deal of expense in prospecting the property and in constructing chutes on the river bank and connecting them with the tunnel by a light tramway, but they gave it up a couple of years later. All that now remains are the collapsed portals of the two tunnels and two old flooded shafts. The course of the old tramway to the river bank can be traced quite easily.

The pit was twice reported on by Mr. L. C. Ball of the Geological Survey. In the first report (Ball, 1913) it is recorded that the syndicate had driven two adits, one on each side of Prior's adit and had sunk a trial shaft three chains south-west of the adits. The seam, which dipped to the east-south-east at an angle of 6 degrees was a little over 6 ft. thick, including from 8 to 13 shale bands. Mr. Ball's sampling of different sections of the seam showed the ash content of the coal to vary from 20·5 per cent. to 30·7 per cent. The generalised section of the seam is:—

	ft.	in.
Coal (with thin shale bands)	2	0
Shale (with ½ inch of coal)	0	8
Coal and shale bands (30·7% ash) ..	0	9
Coal (with thin shale bands)	1	9
Total ..	5	2

In his second report Mr. Ball (1914) estimated reserves of recoverable coal within the property at 198,000 tons.

He mentioned a lower seam of a similar inferior character to the upper seam. A fault which is described as "not inconsiderable" cuts off the coal to the west.

Nothing can be seen of the upper seam, but the crop of the lower seam is well exposed in the bank of a gully on the boundary of portions 133 and 134, where it has been opened up by a costean or small tunnel. The seam is at least ten feet thick, but the coal is very stony and not likely to be workable. It is estimated to be no more than fifty feet perpendicularly below the upper seam.

Two old tunnels were located in portion 130 in one of which a small quantity of coal is lying on the dump. This coal would appear to be on a higher horizon than that on which Prior's Tunnel was driven.

Mr. Ball concluded that "the proposition is not one to enthuse over; yet, with careful, capable and expert management the exploitation of the seam might be made to show an immediate profit; and there will, of course, come a time when the working of such will be rendered imperative by the exhaustion of the cleaner seams convenient to the metropolis."

The identity of the seam in Prior's Pit can only be guessed at as there is no possibility of tracing it for any distance in either direction. The section, however, is somewhat similar to that of Riverside No. 1 Seam, and it is provisionally correlated with that seam.

Fryar's Moggill Pit (abandoned).—This pit was opened up in 1848, only two years after *Redbank*. It was worked for fourteen or fifteen years and when almost exhausted it was flooded and abandoned. Rands (1890) states that the workings covered an area of ten to twelve acres in the south-eastern part of portion 15. They were bounded by the outcrop on the north-west, the river on the south-east and east, and a fault on the south-west. The seam may continue under the river but the cover would not be sufficient for safe working. The country south-west of the fault was prospected by a stone drive from the workings and also on the surface, without result. The seam was 5 ft. 3 in. to 5 ft. 6 in. thick with a thick band of shale 18 inches from the roof and an occasional thin band near the bottom. The general dip of the coal was 1 in 5 to the south-east. This section, like that of Prior's Seam, bears some similarity to Riverside No. 1 Seam and is tentatively correlated with it. If it is Prior's Seam the latter must have been thrown down by at least 150 ft. on the Moggill Pit fault.

Rands reports that in 1889 a tunnel was driven in a westerly direction in portion 14 by John Williams, the owner of the property, to work a seam of coal said to have been intersected in a borehole; but all he found was black shale with thin bands of coal.

A seam of coal cropping out in portion 10 was prospected by the "Moggill Coal Syndicate" in 1927. Reporting on the occurrence, Mr. L. C. Ball (unpublished memo. dated 2nd April, 1928) said that the seam was eleven feet thick but was badly banded, while much of the coal was of inferior quality.

Portion 117, *Moggill.*—Lyons' old shaft in portion 117 was not located. It was reported on by Gregory (1876) as follows:—

> *Mr. Lyons' Coal Seam.*—About one mile to the W.S.W. of the Old Moggill Mine, several outcrops of coal are visible, and a shaft has been sunk seventy feet by Mr. Lyons, on Portion 117, and a seam of coal five and a-half feet thick cut at forty-five feet. The coal has several thin bands of bituminous shale, but, rejecting the bands, there would be from three to four feet of good available coal.

Section taken from the shaft and adjacent outcrops:—

	Feet.
Coarse grit, irregularly stained with iron	10
Coarse conglomerate	8 to 10
Coarse sandstone	20
Hard shales	15
Coal	5½
Thin-bedded sandstones and shales ..	50
Coal	1
Thick-bedded coarse sandstones ..	over 50

It is not known to what extent (if at all) the seam met with in the shaft was worked.

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APPENDIX.

Petrological Notes by T. H. Connah, M.Sc., Geologist.

Mt. Crosby No. 1 (*left bank of Brisbane River*).—A dark grey dense rock, moderately hard and jointed. Along the joints secondary brown iron oxide has been deposited.

In thin section under the microscope the rock is seen to be extremely fine-grained. Small granules of quartz are fairly common, in addition to some small veins and patches of secondary quartz. The only other mineral which could be recognised was a light green micaceous mineral occurring in minute flakes. There is some evidence of banding in the section.

The precise nature of the rock is not clear, but it appears to be an altered sedimentary.

Mt. Crosby No. 2 (*left bank of Brisbane River*).—A dark grey fine-grained rock, in which small felspar laths can be distinguished.

In thin section the rock exhibits a pilotaxitic texture containing laths of plagioclase in sub-parallel arrangement, green hornblende, considerably altered, and small grains of magnetite. Occasional flakes of biotite were seen, and a very small amount of quartz is present. The spaces between these minerals are filled by felspathic material. Some secondary calcite is present.

The rock is an *Andesite.*

Portion 182, *Chuwar.*—A light grey rock of a rather earthy appearance, in which stratification can be distinguished. It contains small white patches, and also brown patches of iron oxide.

In thin section the tuffaceous nature of the rock is apparent. It consists of a light brown base, in which are set fragments of quartz and a few dark-coloured inclusions (apparently of igneous rock). The groundmass is minutely crystalline and possibly partly glassy. Also present are pale-brown fragments, the corners of which are drawn out, of original glassy material, now devitrified.

The rock is an *altered rhyolitic tuff.*

Portion 89, *Chuwar* (*near Mount Crosby*).—A grey rock of fairly fine, even texture containing irregular small patches of chalcedony as cavity-fillings.

In thin section it consists of small plagioclase laths, grains of magnetite, and chloritic alteration products of ferromagnesian mineral. Frequent patches of greenish serpentinous material are scattered through the rock which appear to be the results of alteration of olivine. Secondary calcite occurs in small pockets through the rock.

Altered Basalt.

Portion 172, *Chuwar* (*near Mount Crosby*).—A brown- and greenish-grey fragmental rock, consisting of a fine-grained groundmass in which are embedded numerous fragments of clear quartz, pink to brown felspar, and a few fragments of igneous rock.

In thin section the fragmental nature of the rock is at once apparent. Fragments of quartz and altered felspar (orthoclase?), sometimes showing crystal boundaries, and a few fragments of acid igneous rock, are set in a fine matrix which, in part at least, has been glassy, as is evidenced by the presence of numerous elongate dark shreds.

Rhyolitic Tuff.

Shale, Denmark Hill.—Light pinkish-brown shale of a rather mottled appearance. This it was thought might be an indication of a tuffaceous nature, but examination in thin section did not reveal any evidence in support of such an origin.

Portion 214, *Goodna* (*Intrusive*).—A grey, porphyritic rock, the phenocrysts being almost colourless felspar, occasionally reaching half-an-inch in length.

Microscopic.—The numerous felspar phenocrysts comprise both plagioclase and orthoclase, the latter often embayed. The plagioclase includes several large individuals, as well as smaller ones, and was determined by maximum extinction angle as andesine. The groundmass is in part felspathic, but portion of it is brownish and amorphous, with numerous microlites. Accessory iron-ore and a few wisps of biotite are the only other minerals seen.

Porphyry.

Portion 19, *Bundamba.*—A dark grey fine-grained rock.

Under the microscope it is seen to be made up of laths of plagioclase (labradorite), rather ragged augite of a purplish colour and distinctly pleochroic, abundant granules of olivine, and magnetite grains. The olivine in places is altered to green serpentinous material and magnetite.

Olivine-Basalt.

Shale, Waterworks.—Light brownish shale with a mottled appearance, similar to the Denmark Hill specimen, which it was thought might indicate a tuffaceous nature. In thin section the rock, though of very fine texture, has a "rough" appearance, which suggests that it may be a composite of small fragments of shale. There is no suggestion of a tuffaceous nature.

Portion 204, *Goodna.*—A dark grey markedly porphyritic rock, with phenocrysts of felspar up to half-an-inch or more across.

Microscopic.—The felspar phenocrysts are plagioclase, with maximum extinction angle indicating a medium labradorite for their composition. There are also occasional phenocrysts of olivine and of almost colourless augite. In the groundmass, the constituent minerals are plagioclase, augite granules, abundant magnetite, and less frequent olivine grains, together with greenish alteration products.

Olivine-Basalt.

Near Whitwood No. 4.—The rock consists of about equal proportions of two different types—one dark green and dense, the other light-coloured (mostly brownish, through the presence of iron oxide) and cryptocrystalline. The latter type appears to have invaded or to have replaced the green rock.

In thin section the green portion is seen to be chert, being extremely fine-grained silicious material. The light-coloured part consists of chalcedonic silica in a mass of small spherulites of varying size, each giving an extinction cross between crossed nicols. A few small pockets of secondary quartz are present.

Whitwood "Basalt."—In the hand-specimen the rock is dark grey and of fairly fine grainsize, with an occasional larger phenocryst of felspar. Numerous small felspar laths are recognisable throughout the rock, with a distinct parallelism.

Under the microscope the rock is of porphyritic texture, and the parallelism of the phenocrystal felspar laths is marked. They are all plagioclase, the composition of which is a medium andesine. Olivine grains, with strong tendency to idiomorphism, and occasional augite also appear as phenocrysts. The groundmass contains an abundance of magnetite, together with felspar laths, which also exhibit a parallelism of arrangement.

Olivine-Andesite.

"Boulder," United No. 1.—A dark grey fine textured rock with a somewhat glossy sheen on fresh fractures.

In thin section it is seen to be composed of a crystalline aggregate of brown siderite, with argillaceous matter filling any interspaces.

"Runner," Box Flat Extended No. 4.—Dark grey even fine-textured rock with a distinct banding.

Under the microscope the rock presents the features of a fine-grained sediment. It contains numerous granules of quartz, others which appear to be separate fragments of shale, and carbonaceous fragments. These are set in an exceedingly fine-textured base, which could not be resolved.

"Runner," Old Aberdare, Whitwood.—A grey rock with distinct bedding, carrying a few small fragments of coaly matter.

Under the microscope the bedding is marked. The rock is made up of granules of quartz, clayey material, iron oxide, and fragments of coaly matter. There were also noted what appear to be fragments of shale. The rock exhibits the characters of a sedimentary type.

Dyke in Waterworks Seam.—The specimens are of soft kaolinised porphyritic rock, the phenocrysts being felspars.

A thin section was made, and although the rock is highly altered, it can be recognised as a porphyritic igneous rock with felspar phenocrysts set in a moderately fine-grained groundmass, in which the outlines of original felspar laths are visible.

Limestone Hill, Ipswich.—Six specimens of impure carbonate rocks, all of which contain carbonates of both lime and magnesia.

(1) White, compact, and somewhat earthy, with slight iron staining.

(2) Cream to light brown dense and much iron-stained along cracks. A little dendritic oxide of manganese.

(3) White to brownish, compact. The brownish colour is due to iron-staining. Traces of dendritic manganese oxide are present.

(4) Light brown compact with earthy appearance, but somewhat brittle.

(5) Light greyish-white, with earthy appearance, but somewhat brittle. Some dendritic manganese oxide.

(6) White to light brown dense rock with dendritic manganese oxide common.

All the specimens effervesce with dilute acid, and all leave a considerable amount of insoluble matter, which is probably highest in Nos. 4 and 5. All contain a notable amount of magnesia, in addition to lime.

With a view to determining the origin of the rock a section was made of No. 6. Attempts at sectioning some of the others were unsuccessful. It is seen to be of very fine even grain of very uniform appearance, but the section did not yield evidence as to the origin of the rock.

Portion 130, *Chuwar.*—Light brown hard dense rock, in which a faint banding can be seen.

A thin section was made and shows the rock to be composed very largely of secondary silica. A few angular grains of quartz and occasionally of altered felspar occur. Biotite occurs fairly commonly in small flakes. The section does not afford definite evidence as to the original nature of the rock; but it would seem to be probably an altered and silicified shale.

Road near Mafeking Colliery, Bundamba.—The black rock is a fairly fine-grained basalt, small felspar laths being the only mineral distinguishable in the hand-specimen.

In thin section, the rock shows a porphyritic texture. Numerous small laths of plagioclase and small olivine phenocrysts are set in a fine groundmass composed of plagioclase, iron ore, and chloritised ferro-magnesian mineral.

The light brown-coloured specimens are much altered, but felspar phenocrysts are recognisable.

A thin section of one of these was made. This shows a general similarity of texture and composition to the basalt described above, numerous small plagioclase laths occurring in a fine groundmass, which, however, is largely kaolinised.

These specimens are *altered basalts.*

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QUEENSLAND

DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(C. C. Morton, M.C., A.C.T.S.M., Chief Government Geologist)

PUBLICATION No. 280

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 1, P.D.T.S. Nos. 1, 2 & 3 MINE AREAS, SWANBANK LAGOON

PART 2. P.D.T.S. Nos. 7 & 8 MINE AREAS, BUNDAMBA

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PREFACE.

★

In 1949 Messrs. Powell Duffryn Technical Services Ltd. presented to the Government a report entitled "The Coal Industry of Queensland." The report, which embraced all aspects of the industry following a comprehensive investigation in the field and in the laboratory, recommended *inter alia* an intensive prospecting campaign by diamond drilling for the purpose of assessing reserves, not only in terms of tonnage, but also of quality and type, giving first priority to the most important producing fields.

In giving effect to these recommendations the Government decided to commence drilling at the earliest possible date on the West Moreton (Ipswich) Coalfield, which in point of current production is easily the State's most important field. The scheme recommended for this field involved (*a*) a short-term programme designed to test certain specified areas and (*b*) a long-term programme which had as its objective the assessment of the field's total reserves.

It was recommended that the thirty or so producing pits should gradually over a period of ten years be replaced by seventeen new pits with a considerably increased production capacity. The short-term programme was designed to provide information regarded as essential for the proper planning of the proposed new collieries. Nos. 1, 2 and 3 mine areas in the vicinity of Swanbank Lagoon were selected to initiate the campaign and the first hole, No. N.S.9 (1950), was commenced in February, 1950.

The report on Nos. 1, 2 and 3 Mine Areas which constitutes part of this Publication is the first of a series which it is proposed to publish as drilling progresses. Part 2 is a report on Nos. 7 and 8 Mine Areas, Bundamba, which were drilled on the completion of Nos. 1, 2 and 3 Mine Areas. These reports may be regarded as supplementary to the general report on the Ipswich Coalfield (G.S.Q. Publication 279) by A. K. Denmead.

The drilling was done by the Mines Department, using three (sometimes four) rigs. The bore cores were logged and the areas geologically mapped by the Coal Section of the Geological Survey. The bores have been accurately located and the areas topographically surveyed, all levels being on State datum. Summaries of the results of the drilling will be found at the beginning of each report.

C. C. MORTON,
Chief Government Geologist.

PART 1.—P.D.T.S. Nos. 1, 2 AND 3 MINE AREAS, SWANBANK LAGOON.

SUMMARY.

This report sets out the results of a departmental boring campaign carried out between February, 1950, and December, 1951, and designed to establish reserves of coal in the Nos. 1, 2 and 3 mine areas of Messrs. Powell Duffryn Technical Services Ltd. in the Swanbank Lagoon portion of the Ipswich Coalfield.

In all, nineteen holes (including two repeats and one deflection) were put down by the Boring Branch of the Department to depths ranging from 635 ft. to 1,461 ft. and aggregating 19,605 ft. 9 in.

The primary objective was the Bluff seam, but the boring has resulted also in proving a total of some 20 million tons in two seams—the Wright and Lagoon —underlying it within an interval of 200 feet. Though the existence of these two seams had been known from shallow workings for many years, so little was thought of them that, with the possible exception of the small United No. 5 Colliery, no attempt was made to work them.

Perhaps the outstanding result to emerge has been the extent to which the bottom 10 feet or so of the thick Bluff seam is of workable quality, no less than 11·3 million tons of coal with an average ash content of 22·2 per cent. having been proved in an area of 673 acres. In this 30-foot seam, too, further substantial measured and indicated reserves amounting to 6,772,000 and 2,750,000 tons respectively have been proved in top and middle sections.

In estimating reserves an ash content of 30 per cent. has been taken as the cut-off line and tonnages are based on average specific gravities for all relevant samples. On this basis and omitting stone bands excluded from samples, total reserves in "Tops," "Middles" and "Bottoms" of the Bluff seam and in the Wright and Lagoon seams amount to 39,884,000 tons, of which 27,634,000 tons are classified as measured and 12,250,000 tons as indicated.

The areas thus included are defined on a plan, and a table on the final page of the report sets out details of acreages, average seam thicknesses and average ash contents for the individual seams under each category.

Introduction.

In order to put into effect certain of the recommendations of Powell Duffryn Technical Services Ltd. boring was commenced on 23rd February, 1950, in the Swanbank Lagoon Area by the Boring Branch of the Mines Department, using one plant (a Sullivan 200A). Subsequently three more plants were added—a Joy Sullivan 37, a Sullivan 22 HD, and a Failing 2500. Drilling of Nos. 1, 2 and 3 Areas was completed on 11th December, 1951. Nineteen holes were bored (two of them repeat holes) to depths ranging from 635 ft. to 1,461 ft. and aggregating 19,605 ft. 9in. These have been numbered N.S. 9 to N.S. 27.

The object of the drilling was to enable an evaluation to be made of reserves, particularly in the Bluff Seam, in Nos. 1, 2 and 3 Mine Areas as selected by Messrs. Powell Duffryn Technical Services Ltd. These areas are situated about Swanbank Lagoon between 3 and 4½ miles south of Bundamba Railway Station.

With an upward limit of 30 per cent. ash and a minimum limit of 2 ft. 6 in. in thickness reserves of coal in Nos. 1, 2 and 3 Mine Areas are estimated to be 39,884,000 tons, comprising 27,634,000 tons measured reserves and 12,250,000 tons indicated reserves in three seams included within 200 ft. of strata.

This report is accompanied by two maps of the area, one showing surface contours, bore locations and surface geology; the second showing seam contours, bore locations, mine workings (with sampling locations), and reserve areas P.D.T.S. Nos. 1, 2, 3 Mine Areas are shown on both. Also annexed are generalised bore sections (N.S. 9 to N.S. 27); five cross sections, and detailed seam sections showing sampling and analytical data.

Procedure.

The bores, which were drilled as nearly as possible on sites recommended by P.D.T.S. Ltd., were spaced roughly on a 20 chain grid with some modifications necessitated by topography and other considerations.

For various reasons it was not possible to drill all the holes required to test No. 1 Mine Area; furthermore subsequent boring revealed very considerable "wants" in No. 3 Mine Area. For these reasons it is more convenient to treat these three contiguous areas as one, rather than report separately on each.

Bore logs have been prepared by officers of the Coal Section of the Geological Survey from examination of bore cores and ditch samples. Coal sections, after being logged in detail by the Geological Survey, were examined by Engineer Members of the Queensland Coal Board. Samples from agreed sections were then submitted to the State Government Analyst for determination of proximate analysis, sulphur, calorific value and specific gravity. No general rule has been adopted as to the exclusion of stone bands. If in the opinion of the mining engineers the band seemed likely to be excluded in actual mining it has been excluded from the sample, in which case its ash content and specific gravity have been determined. Ultimate analyses and other tests are being made of composite samples representative of each working seam.

In those cases where cores were incomplete, and particularly where they were fragmented, there is uncertainty as to the exact position, and sometimes even the number of the stone bands. For this reason

the graphic sections of coal seams presented herewith are to be regarded as approximate only unless core recovery was complete.

Geological Features.

In the Swanbank Lagoon area seven coal seams have been penetrated, but only three have been shown to be capable of yielding appreciable quantities of coal. The seams in descending order are:—

Little West Moreton
(?) New Found Out
Aberdare
Bluff
Wright (previously unnamed)
Lagoon (previously unnamed)
Unnamed Seam (possibly Rob Roy)

All seams named except the Little West Moreton occur in the Blackstone "Stage" of the Ipswich Coal Measures of Triassic age.

The Little West Moreton Seam which lies within the Bundamba Sandstone was found only in N.S. 9 and N.S. 10. It contained 9 inches of coal in the latter, but in the former there were only thin coal bands. It is of no economic interest in this area. What may be the New Found Out Seam was penetrated in N.S. 26, N.S. 10 and N.S. 17. Only in N.S. 26 was there a possibly workable section, but core recovery was not sufficient to be sure of this. In any case there has been extensive caving, extending to the surface, in old workings on the Aberdare Seam 50 ft. below, and for this reason there is little prospect of the New Found Out seam (if such it be) ever being worked in this area.

The Aberdare Seam was identified only in the most northerly boreholes, where it was found to be split into two sections up to 100 ft. or more apart. Both sections of the Aberdare Seam were found to deteriorate very quickly going south and west and neither has been positively identified beyond (south of) N.S. 17. A limited tonnage of coal in the bottom section still remains to be worked out adjacent to existing workings in Box Flat Extended No. 2 Colliery. The top section may be regarded as completely worked out.

In point of proved reserves and quality, the Bluff Seam is incomparably the most attractive of the seams in the Swanbank Lagoon Area. Lying approximately 100 ft. below the Aberdare Seam it has an average thickness of slightly more than 30 ft. It is a much banded seam with a good deal of inferior coal and is nowhere workable over its entire thickness. There is a great deal of variation both in the number and thickness of the stone bands and in the thickness and quality of the coal plies, particularly in the middle section of the seam. The best section and the least affected by banding is the bottom 9 to 10 ft. Somewhat inferior, but still workable over a wide area is the top 5 to 6 ft. A third section which has been shown to be workable over a fairly wide area lies 5 to 6 ft. below the top section. In most of the holes the quality of the coal plies outside of these three sections is very inferior, but in some cases good coal extends 5 or 6 ft. above the bottom section. It may perhaps be possible to work this coal over limited areas, and it is recommended that this coal should be tested as development proceeds. In one of the bores (N.S. 19) there was coal of better than average quality immediately under the "Tops", but elsewhere this was a very inferior section.

The Bluff Seam deteriorates both as to quality of coal and as to frequency of bands towards the southern part of the Swanbank Lagoon Area. The bottom section is unworkable over two-thirds of No. 3 Mine Area and the "Tops" over a rather larger area.

There is no indication of any general deterioration of the Bluff Seam in the direction of dip north of N.S. 12 and an extension of mining operations to greater depths would only be limited by roof conditions. North of the bored area the position is uncertain. The Bluff Seam is reported to have been thin and inferior in Aberdare Extended No. 1 Mine, though it must improve towards the outcrop as it was worked in Noblevale No. 5 Colliery in portion 297. The Extended Fault which runs roughly east-west cuts off the coal some 600 yards north of the most northerly bore-holes and would, in any case, terminate mining in this direction.

Though the most southerly boreholes show no workable section in the Bluff Seam, the coal must start to improve again going east, as there is a workable section in New Hope Colliery in portion 99 parish of Bundamba, one mile east of N.S. 24. The faulted nature of the intervening country, however, would seriously restrict the scale of mining operations.

Lying usually from 50 to 70 feet below the floor of the Bluff Seam there is a seam of coal, hitherto unnamed, to which we have given the name "Wright", after one of the pioneering families of the district. This seam was penetrated in all the bores that went down far enough to reach it. The Wright Seam varies in thickness from 8 feet to 26 feet. Usually, however, only the upper section, varying from 3 feet 10 inches to 9 feet 11 inches and averaging 6 feet 5 inches, is workable. The seam splits in the southern part of the area, but the bottom portion is very inferior and does not show a workable section in any of the holes. The seam is at its best in the central portion of the bored area and it deteriorates somewhat to the north and to the south.

Boring done by Queensland Industries Pty. Ltd. on behalf of the Mines Department indicates that the Wright seam does not persist as far north as portion 298, Goodna, for only carbonaceous shale was found where the seam was expected. The limits of workability have not been reached in a south-easterly direction. In N.S. 24 the coal was not much below average grade but in N.S. 23, some 30 chains to the dip, the ash was too high (31.6 per cent) for present working. With this exception no deterioration is indicated to the dip.

The Wright seam has not been worked in this area. There is an old tunnel on it near Thistle No. 4 Colliery, but we have not been able to find the outcrop of the seam any further south. It is said to

have been located in a shallow bore in portion 5, Bundamba, near Box Flat Extended No. 5 Colliery, and preparations are being made to drive a tunnel on it for use as a return airway for that mine. Further south, according to Mr. T. Rae, Inspector of Mines, the crop of the Wright seam was found in an excavation behind (north-east of) United No. 5 Extended tunnel.

The next seam, in descending order, which we have named the "Lagoon", lies 50 to 100 feet but usually no more than 70 feet below the Wright Seam. It is possible that the Lagoon is identical with the Four Foot seam, but as both seams completely disappear in the vicinity of the old Box Flat Colliery and as the usual Four Foot bands have not been recognised in the Lagoon seam the correlation cannot be established beyond doubt. Like the Wright Seam the Lagoon shows considerable fluctuations in thickness. The boring has shown workable sections varying from 3 ft. 6 in. to 11 ft. 3 in., the average being 6 ft. 9 in. The workable sections are not always in the same position relative to the roof and floor, possibly due to the irregular development of coal bands above and below it.

The Lagoon Seam has a rather high "inherent" ash content but as a rule it carries few major stone bands. It was penetrated in every hole that was drilled deep enough to intersect it except N.S. 23, the southernmost bore in the area.

Like the Wright Seam the Lagoon shows indications of deterioration both to the north and to the south-east of the bored area. The seam was not located in the bore drilled by Queensland Industries Pty. Ltd. in portion 298, parish of Goodna. It was not workable in any of the deeper boreholes in No. 3 Mine Area, but the chances are that it will continue for some distance to the south-east in the shallower ground.

Little is known of the Lagoon Seam at the outcrop. A seam of coal which may be the Lagoon crops out at the surface in portion 12, parish of Goodna. It has been prospected in a trial shaft in portion 5, parish of Bundamba, and in N.S. 1 (1943) borehole nearby. It is believed that the seam being worked in United No. 5 Colliery may be the Lagoon, but the correlation has yet to be confirmed. This seam is cut off by a fault near the surface and is not known to outcrop.

The lowest known seam in the area lies about 100 ft. below the Lagoon Seam. This seam, which may possibly be identical with the Rob Roy Seam, showed no promise in the two boreholes which penetrated it, nor in the old N.S. 1 (1943) borehole near Box Flat No. 5 Colliery.

The coal measures in the Swanbank Lagoon area strike north-north-west—south-south-east and dip to the west-south-west except in Southern Cross Nos. 6 and 7 Collieries, where the country is disturbed by faulting and minor folding. At the outcrop dips are mostly of the order of 25° to 35°, but dipwards they quickly flatten to 10° or less. The average dip of the strata in the boreholes was approximately 10°.

Except in the shallow ground about Southern Cross Nos. 6 and 7 Collieries the area appears to be remarkably free from major faults, and even minor faults are few in number in the colliery workings. A few faults have been pierced by the drill holes, but no major disturbance is indicated by the subsurface contours. Igneous intrusions have been found in the form of dykes in Southern Cross Nos. 6 and 7 Collieries, while Box Flat No. 6 Colliery has been troubled by an unusually persistent sill. No dykes were pierced by the drills, but sills were found in the lowest part of the Lagoon Seam in N.S. 25 and in N.S. 22. The destruction of coal through this agency does not appear to have been serious.

Generally speaking roof conditions in the Swanbank Lagoon area are only moderately stable. In the Bluff "Tops" the roof is a fairly strong shale. In the lower sections of the seam, however, the roof consists of coaly measures which may give trouble in the deeper ground. The working section of the Wright Seam is near the top but there will be some coaly measures over it in places. The Lagoon Seam will everywhere have a roof of coaly measure

Coal Evaluation.

In the early holes core recoveries in coal varied considerably. Of necessity the quality of the coal has in some cases been judged on rather low percentage core recoveries and the reliability of the estimates of quality and tonnage has suffered accordingly. It is considered, however, that the results err on the conservative side as in general the coal, being softer than the shale bands, would grind away more readily, leaving an unduly high proportion of stone or inferior coal. For the purposes of estimating reserves samples that gave an ash value in excess of 30 per cent. have been ignored.

It is considered probable that because of core losses, workable thicknesses of coal, especially in the top section of the Bluff Seam, which suffered more than other seams in this respect, will in many cases be greater than those shown in the annexed columns.

In regard, therefore, to both quality and quantity the estimates are considered to be conservative.

The coal included in measured reserves is that embraced by the boreholes in which the seam was shown to have a workable section and for a distance of five chains beyond the outermost holes, provided no marked deterioration was evident in them. In the case of the Bluff Seam the area of measured reserves has been extended to the perimeters of mine workings to the rise of the boreholes, or, where no mine workings exist, to the outcrop.

So little is known of the Wright and Lagoon Seams in the shallower ground that extension of the area of measured reserves to the outcrops is not warranted. Accordingly this coal is presented as indicated reserves. The middle section of the Bluff Seam has been similarly treated as it has not been tested in mine workings. Before measured reserves could be calculated for the Wright and Lagoon Seams between the bores and the outcrops supplementary drilling would be necessary.

As regards rank all the samples except one fall within the high-volatile bituminous group. Moisture is usually between 1·5 and 2·5 per cent. and sulphur between 0·14 and 0·32 per cent.

Reserves.

Bluff Seam—Top Section. The weighted average of all the relevant ash values (12 samples) is 27·0 per cent. and the average thickness based on bore cores and mine sections sampled is 5 ft. 3 in. Mine measurements, however, suggest that the working thickness may be nearer 6 ft. and for reasons previously stated ash value of this section may be expected to be somewhat less than the figure quoted above. In two holes N.S. 20 and N.S. 25 where boring did not show a workable section, but where core losses were high, workable sections have been assumed to exist. The mean specific gravity is calculated at 1·526.

The area of mineable coal is 507 acres. Measured Reserves are estimated at 4,937,000 tons. The greatest vertical depth of all sections of the Bluff Seam would be approximately 1,100 ft. Average fixed carbon on a dry, mineral matter-free basis is 63·99 per cent., extremes being 62·01 per cent. and 66.35 per cent.

Bluff Seam—Middle Section. The average ash (7 samples) is 26·7 per cent. and average thickness 4 ft. 10 in. The mean specific gravity is 1·523. As with the top section the ash is in all probability overestimated, though, because of better core recoveries, to a less degree. Area within which measured reserves have been calculated is 205 acres. Measured Reserves are estimated at 1,835,000 tons. Area of indicated reserves is 307 acres. Indicated reserves are 2,750,000 tons. Average fixed carbon on a dry, mineral matter—free basis is 63·56 per cent., with extremes of 61·7 per cent. and 65·58 per cent.

Bluff Seam—Bottom Section. Average ash of this section (15 samples) is 22·2 per cent. and average thickness 9 ft. 4 in. This is slightly less than the working thickness of the "Bottoms" in Box Flat Extended No. 5 Colliery. Mean specific gravity is 1·484. In places coal of workable quality extends for 5 ft. or so above this section. If it should prove practicable to work it in these places there would be a corresponding increase in available tonnage. The area of workable coal is 673 acres. Measured reserves are 11,310,000 tons. Average fixed carbon on a dry, mineral matter—free basis is 64·15 per cent. (omitting one abnormal value of 72·55 per cent.). Extremes are 60·87 and 67·76.

Wright Seam. The average ash content of the Wright Seam (12 samples) is 24·4 per cent. and the average thickness 6 ft. 5 in. Mean specific gravity is calculated at 1·500. Core recoveries generally in the holes to the west of Bundamba Creek were not good and for this reason it is considered that the average ash figure stated above is likely to exceed the true figure. The area within which reserves have been calculated is 491 acres.

Estimated measured reserves are 5,360,000 tons. Indicated reserves on the same basis are estimated at 4,400,000 tons. The maximum vertical depth would be approximately 1,250 ft. Average fixed carbon on a dry, mineral matter—free basis is 64·87 per cent. The extremes are 62·96 per cent. and 66·93 per cent.

Lagoon Seam. Average ash (11 samples) is 26·0 per cent. and average thickness 6 ft. 9 in. The mean specific gravity is 1·516. The inherent ash of the Lagoon Seam is rather high and it is not expected that the actual average ash will be much under the above figure.

In N.S. 19 the Lagoon Seam gave an ash figure of 27·4 per cent. over 7 ft. In view of the fact that the seam contained no workable coal in N.S. 15 to the north-west or in N.S. 23 to the south-east, this hole has been excluded from the area of workable coal.

Measured reserves (337 acres) are estimated at 4,192,000 tons. Indicated reserves (413 acres) are estimated at 5,100,000 tons. The greatest vertical depth would be approximately 1,350 ft.

Total measured reserves proved by boreholes and mine workings (all seams) are estimated to be 27,634,000 tons. Total indicated reserves (Bluff "Middles," Wright and Lagoon Seams) are estimated at 12,250,000 tons. Total measured and indicated reserves 39,884,000 tons.

Summarised reserves are as follows: —

Seam.	Average. Thickness.	Average Ash.	Measured Reserves.		Indicated Reserves.	
			Area.	Quantity.	Area.	Quantity.
	Ft. in.		Acres.	Tons.	Acres.	Tons.
Bluff "Tops"	5 3	27·0	507	4,937,000	..	..
Bluff "Middles"	4 10	26·7	205	1,835,000	307	2,750,000
Bluff "Bottoms"	9 4	22·2	673	11,310,000	..	..
Wright	6 5	24·4	491	5,360,000	382	4,400,000
Lagoon	6 9	26·0	337	4,192,000	413	5,100,000
				27,634,000	..	12,256,000

PART 2.—P.D.T.S. Nos. 7 AND 8 MINE AREAS, BUNDAMBA.

SUMMARY.

In further implementing the P.D.T.S. Ltd. recommendations for testing mine areas on the Ipswich Coalfield, the departmental drilling plants, on completion of the testing of Nos. 1, 2 and 3 areas at Swanbank Lagoon, commenced drilling the Nos. 7 and 8 Mine Areas at Bundamba on November 2nd, 1951. The fifteen holes found to be necessary under a considerably modified scheme were completed by the end of July last. With holes ranging from 111 ft. to 1,009 ft. in depth the aggregate footage drilled (including four deflections) was 9,051 ft. The area thus tested was some 440 acres.

Tertiary strata (sediments overlain by basalt) deposited on an eroded surface of the Ipswich Coal Measures occupy the western part of the tested area to depths ranging to 412 ft. in N.S. 34. The pre-Tertiary erosion proved sufficient not only to have entirely removed the Aberdare seam from the area, but also to have destroyed a large proportion of the Bluff Seam and to a minor degree the Four Feet Seam as well. In addition to testing the above seams, where present, the bores were continued to the Bergin, Striped Bacon, Rob Roy and Lindsay's Hard Seams.

Using cut-off limits of 30 per cent. for ash and 2 ft. 6 in., for seam thickness only three of the seams—Four Feet, Bergin and Rob Roy—were found to contain reserves.

Expressed in each case as measured reserves the *total* reserves in these seams were calculated at 1,700,000 tons for the Four Feet, 1,280,000 tons for the Bergin and 3,650,000 tons for the Rob Roy, making an aggregate of 6,630,000 tons. *Available* reserves can, however, be expected to fall considerably short of that figure because of losses due to faulting (two major faults traverse the area) and additionally in the case of the Four Feet seam due to undisclosed destruction by erosion. It is of interest to note here that, while the boring has disclosed workable limits for the Four Feet and Bergin Seams, the position regarding the Rob Roy Seam is that it continued to improve to the dip and, particularly towards the south-west, a considerable extension of workable coal can be envisaged, The reserve areas on each seam are defined on a plan and a table on the final page of the report sets out details of acreage, average seam thickness and average ash content for each seam.

Introduction.

I have the honour to present a report on the results of the Department's diamond drilling programme at Bundamba.

The report is the result of a co-operative effort by the officers of the Coal Section. The logging of cores and plotting of bore logs is the work chiefly of Mr. McKenzie. The geological mapping and the preparation of structure contours was entrusted to Mr. Cuthbert. The calculation of fixed carbon values, average ash values and coal reserves was undertaken by Mr. Mellor. Mr. Hawthorne assisted in various aspects of the work when not engaged at Burrum or Rosewood.

On completion of the drilling programme in the Swanbank Lagoon Area (see report dated 15th April, 1952) the plants were moved to Bundamba in order to drill Nos. 7 and 8 Mine Areas as selected by Powell Duffryn Technical Services Ltd. These are contiguous mine areas lying immediately south of Bundamba on the Southern and Western Railway. At first four plants were employed, but one (the Sullivan 22HD) was withdrawn after drilling one hole and placed in service at Rosewood. Drilling commenced on 2nd November, 1951, and was completed on 29th July, 1952. Fifteen holes were drilled ranging in depth from 111 ft. to 1,009 ft. Total footage drilled, including four deflections, was 9,051 ft. The holes have been numbered N.S. 28, N.S. 29, N.S. 31 to N.S. 42 and N.S. 44. Area embraced by the drilling programme is approximately 440 acres.

This report is accompanied by seven maps of the area on a scale of four chains to an inch. One shows surface contours and surface geology; another shows mine workings (with sample locations) and areas within which reserves have been calculated. (Both of these plans show Nos. 7 and 8 Mine Areas and bore locations). There are four skeleton plans showing seam contours, one showing pre-Tertiary surface contours and also an isopach map showing the split of the Bergin Seam. There are in addition a locality map showing the grid relation of the Bundamba and Swanbank Lagoon areas; four cross-section generalised bore logs and detailed seam sections showing core recoveries and analyses.

The drilling as recommended by Powell Duffryn Technical Services Ltd. was considerably modified. For reasons which will be explained later the more southerly holes in No. 8 Mine Area were not drilled and three additional holes were drilled north of No. 7 Mine Area. Total reserves of coal considered as workable under existing conditions (maximum ash 30 per cent., minimum thickness 2 ft. 6 in.) within the drilled area are estimated at 6,630,000 tons in three seams. The whole of these reserves are classified as "measured".

The bores were drilled on an approximately 20 chain grid as nearly as practicable on sites selected by Powell Duffryn Technical Services Ltd. A number of holes had already been drilled by Messrs. Queensland Industries Pty. Ltd. to the east of Bundamba Creek and as the Company had kindly made the result of the drilling available to the Mines Department it was not considered necessary to drill further holes. No. 7 Mine Area as designed by Messrs. Powell Duffryn Technical Services Ltd. was bounded on the north by the Braeside Fault. It has, however, been

shown that it would be practicable to work the coal beyond the fault from Aberdare No. 8 Colliery. Accordingly three bores were drilled north of the Braeside Fault primarily to test the Four Feet and Bergin Seams.

Bore cores and (where non-coring bits were used) sludges have been examined and logs have been prepared by officers of the Coal Section of the Geological Survey. All coal sections were inspected by one or more engineer members of the Coal Board and sections selected jointly by the Board and the Geological Survey were submitted to the State Government Analyst for proximate analysis and other tests where warranted. All stone bands were included in the sample unless it was considered they would be excluded in the course of normal mining operations.

Illustrating the report are:—

(1) A locality map.

(2) Two plans (10 chains to an inch) with superimposed 10 chain grid showing bore locations, P.D.T.S. Mine Areas Nos. 7 and 8 and, additionally between them, surface contours at 10 ft. intervals, surface geology, mine workings (with sample locations) and reserve areas on three seams.

(3) Four skeleton maps showing seam contours.

(4) Map showing pre-Tertiary surface contours.

(5) An isopach map showing splitting of the Bergin Seam.

(6) Cross sections (four).

(7) Generalised bore logs (N.S. Nos. 28, 29 31 to 38, 40 to 42 and 44).

(8) Detailed seam sections with core recoveries and analytical data.

Geological Features.

The bored area is traversed by Bundamba Creek which follows roughly the boundary between the coal measures (to the east) and the Tertiary rocks of the Redbank Plains Formation (to the west). The Tertiary beds have been deposited on an eroded surface of the Ipswich Coal Measures. As the deposition of Tertiary sediments proceeded the surface on which they rested gradually sagged, attaining a depth of 800 ft. or more below sea level in the deepest part of the Tertiary basin. In the bored area the deepest Tertiary beds were just over 300 ft. below sea level. In consequence of the sagging the Tertiary strata are tilted near the edges, dips of up to 10 degrees having been recorded in the drillholes.

The Tertiary rocks comprise shale, slickensided mudstone, thin sandstone and some limestone and clay ironstone, with overlying basalt in which thin shale beds may be interbedded. The shales are usually buff coloured and very fine-grained. They split readily parallel with the bedding. A few fossil remains, including leaf fragments, fish scales and bones, have been found in the shales.

As was to be expected the coal measures were found to be weathered immediately under the Tertiary beds. In N.S. 37 the Four Feet Seam which lay some 12 ft. below the pre-Tertiary surface was weathered, while in the two holes drilled north of the Brisbane Road (N.S. 33 and 36) the Four Feet Seam was eroded, the first seam intersected in both holes being the Bergin.

There are six seams in the area covered by the drilling, three of which have been shown to be workable. The seams are (in descending order)—

Bluff
Four Feet
Bergin
Striped Bacon
Rob Roy
Lindsay's Hard

The *Aberdare Seam* which lies one hundred feet above the Bluff has been removed by erosion throughout the bored area.

The *Bluff Seam* was penetrated only in three holes, N.S. 31, 32, 34, having been eroded over the greater part of the area in pre-Tertiary times. In N.S. 32 the Bluff Seam consisted of alternating coal and shale bands and was only 9 ft. thick. This hole was drilled as nearly as possibly on the site of the Borehole Company's No. 2 Bore in which, according to A. Gibb Maitland (Annual Progress Report of the Geological Survey for 1895), the Aberdare Seam was intersected at a depth of 232 ft. This is the depth at which the Bluff Seam was met with in N.S. 32 and it is obvious that it was the Bluff Seam and not the Aberdare, that the old bore penetrated. In N.S. 31 the Bluff Seam was split into two sections respectively 24 ft. and 12 ft. thick separated by 12 ft. of shale. There was no workable section in either of these holes.

N.S. 34 passed through a seam of coal between 463 ft. and 483 ft. 6 in. which from its position in relation to the Four Feet Seam, is believed to have been the Bluff. Core recovery was only 8 per cent. and an attempt was later made to deflect the hole so as to obtain a second penetration of the seam. This attempt was unsuccessful and practically nothing is known of the seam at this point.

The *Four Feet Seam* (formerly known as the *Four Foot*) was intersected in all but four of the bores. The stratigraphic interval between the Bluff Seam and the Four Feet Seam (pavement to pavement) varies in the bores from 156 ft. to 230 ft. The Four Feet Sandstone which lies between these two seams varies in thickness in this area from 70 ft. to 186 ft. At Bundamba the Four Feet Seam, as worked, is usually about 4 ft. 6 in. thick. Immediately overlying the seam there are two cream-coloured stone bands 1 to 2 inches thick separated by 1 to 2 inches of coal, and these are succeeded by 18 to 20 inches of inferior coal. The two light coloured bands in the roof of the Four Feet Seam are a permanent feature of the seam and are of great importance for correlation. The Four Feet Seam was known to deteriorate along a N.N.W.-S.S.E. line passing through Blackstone Village. The boring in the Bundamba area shows the line of deterioration to persist almost as far as the

main Brisbane-Ipswich highway. In the two bores drilled to the north of the Brisbane-Ipswich highway the Four Feet Seam was wanting having been eroded prior to the deposition of the Tertiary strata.

In the western workings of Aberdare No. 6 Colliery there is a "washout" of the Four Feet Seam measuring at least 10 chains in length and 6 chains in width. Mr. T. H. Connah, Geologist, after an inspection (Report dated 4-4-50) concluded that the washout was contemporaneous. He based his conclusion on the observed fact that at the one exposure available for examination the roof shale appeared to continue beyond the edge of the washout. The pre-Tertiary surface contours, when superimposed on the Four Feet Seam contours indicate that there should be in the vicinity of 50 ft. of coal-measure cover in the washout area, thus providing support for Mr. Connah's view; on the other hand the fact that the coal shows increasing deterioration approaching the washout suggests that the erosion took place subsequent to "coalification" that is in the period immediately preceding the deposition of the Tertiary strata. Had the erosion been contemporaneous no deterioration of the coal would be expected. Furthermore the pre-Tertiary surface contours are based on a few widely spaced boreholes and for that reason might not necessarily reveal a narrow depression in bedrock. In the face of the apparently conflicting evidence the age of the washout must remain "not proven."

In Aberdare No. 8 Colliery the *Bergin Seam* lies 60 to 80 ft. stratigraphically below the Four Feet Seam. In the boreholes the seams have been found to lie from 29 ft. to 92 ft. apart. The Bergin Seam varies considerably in total thickness. The worked section which lies immediately under a shale roof is on an average 4 ft. 6 in. thick in Aberdare No. 8 Colliery. Under the worked section there are up to 14 ft. of coal and interbedded shale, but usually no more than 6 to 7 ft. Going west from the outcrop in portions 160 to 164 parish of Goodna the Bergin Seam splits into two sections which are separated by as much as 64 ft. of barren strata. They come together again in the deepest holes in the north but remain split in the south (see isopach map). In no case did the bottom split show a workable section.

The *Striped Bacon* (often called the Strip of Bacon) Seam is separated from the overlying Bergin Seam by from 45 ft. to 112 ft. of strata, mostly shale. There occurs in the shale between these two seams the small fossil crustacean *Estheria*. The body of *Estheria* is covered by a carapace which takes the form of a bivalved shell resembling a lamellibranch and which alone is preserved in the fossil state. This fossil had previously been found at only two localities in the Ipswich district and not at all in bore cores. In the Bundamba bores its vertical range was 10 to 15 ft. In some holes it was abundant, in others only a few specimens were found. It proved of great value as a "marker" in those holes where seam correlations were uncertain.

The quality of the Striped Bacon Seam was generally poor, only five holes showing anything like a workable section, and of these three had ash values in excess of 29 per cent. The total thickness of the seam varies from 5 ft. 6 in. to 13 ft. 6 in. The workable or near-workable sections ranged from 3 ft. 2 in. to 4 ft. The drilling results suggest that there may be a small area of workable coal in the vicinity of N.S. 36 and N.S. 37. An examination in 1944 of the Striped Bacon Seam in an old adit in William Street, Blackstone, showed a section 3 ft. 8 in. in thickness of what appeared quite good quality coal. There may thus be a small area of workable coal on the east side of Bundamba Creek.

The *Rob Roy Seam* about which very little was known in the Bundamba area prior to the drilling, proved to be the most attractive of all the seams. It lies from 23 ft. to 36 ft. stratigraphically below the Striped Bacon Seam (floor to roof) and varies in thickness from 3 ft. 8 in. to 8ft. 6 in. The working section ranges in thickness from 3 ft. to 6 ft. 5 in. and averages 4 ft. 8 in. While most of the sections show one or more stone bands none appears to be permanent. The coal shows an improvement both in quality and thickness towards the south-west of the drilled area where the cover is approaching 1,000 feet.

Lindsay's Hard Seam lies approximately 130 ft. below the Rob Roy Seam. Between the two seams and commencing usually no more than 30 ft. below the Rob Roy Seam there is a succession of thick beds of coarse sandstone of rather striking aspect that is identical in all respects with the sandstone that was found lying some 400 ft. below the Bluff Seam in the Swanbank Lagoon area. A seam occurring a short distance above the coarse sandstone in the latter area was tentatively correlated with the Rob Roy. The position of the Rob Roy Seam in relation to the coarse sandstone in the Bundamba area lends a measure of support to this correlation. In none of the four bores that pierced it did the Lindsay's Hard Seam show a workable section. The seam was worked many years ago in the Braeside Colliery immediately east of the bored area.

The coal seams in this area are bent into a wide synclinal fold the axis of which pitches south-westerly. Under its influence the strike of the beds swings from north to west-north-west in the vicinity of the Bundamba Racecourse Reserve. Immediately north-east of the bored area the strike swings sharply to the east to form an anticlinal structure pitching north-westerly. This folding is subsidiary to the main Bundamba anticline and it is attributed to the severe drag associated with the Gilliver Fault which lies some 350 yards north of the old Blackball Tunnel.

The area is traversed by two large parallel faults striking approximately E.N.E.-W.S.W. The downthrow in both cases is to the N.N.W. The more southerly fault, the Coronation, has a throw of approximately 130 ft. in the vicinity of the more southerly outcrop of the Four Foot Seam. Going west-south-west the throw first increases (to 160 ft. near the eastern boundary of the Racecourse Reserve) and then decreases rapidly to a known minimum of 12 ft. 6 in. two chains beyond the western boundary of the Bundamba Racecourse Reserve.

The Braeside fault lies approximately 22 chains from the Coronation Fault. The throw on this fault increases from approximately 100 ft. in portion 246, Goodna, to a maximum of 190 ft. in portion 159. Where workings on the Bergin Seam in Aberdare No. 8 Colliery penetrated the fault at a point directly under the middle of the southern boundary of the School Reserve (R.961) they entered the Four Feet Seam. As the interval between the two seams hereabouts is 80 ft. it follows that the throw of the fault at this point must also be 80 ft. The trend of the structure contours suggests that the throw decreases going west and that the fault probably dies out in the vicinity of Bore No. N.S. 38.

A notation on an unpublished map by the late W. E. Cameron stated that the Braeside Fault had a downthrow of 10 ft. to the north in portion 159. On this evidence the previously accepted correlation of the top three seams met with in the Braeside No. 1 Shaft as the Bergin, Striped Bacon and Rob Roy was untenable and the writer, in an earlier report (The West Moreton [Ipswich] Coalfield, by A. K. Denmead, 1946), concluded that the uppermost of the Braeside Seams was in all probability the Rob Roy. The drilling has now demonstrated beyond doubt that Cameron's correlations were correct. This fits in with the very much greater throw (190 ft.) of the Braeside Fault which the recent drilling has proved.

Queensland Industries Pty. Ltd. Boreholes.

Prior to the commencement of the Department's drilling campaign a number of diamond drillholes had been put down by Messrs. Queensland Industries Pty. Ltd. in the vicinity of Blackstone Village with the object of testing all the seams down to the Rob Roy. Use has been made of these holes in construction of seam contours, but not in the estimation of coal reserves.

No. 4 hole in portion 163, Goodna, ran into faulted country and was abandoned at 298 ft.

No. 7 hole in portion 173, Goodna, was expected to intersect the Bergin Seam at about 30 ft., but the driller reported no coal. This was surprising as in Price's Adit nearby the seam was eleven feet thick and although weathered was easily recognisable as a seam at this depth. No workable section of coal was reported in this hole which was drilled to a depth of 606 ft. The log shows 9 in. of coal at 82 ft., 18 in. of coal at 116 ft. and 2 ft. 3 in. of coal and shale at 150 ft. It is assumed that the seams at 116 ft. and 150 ft. are respectively the Striped Bacon and Rob Roy Seams. The Rob Roy Seam apparently was not workable here, rather surprisingly, as it is generally a good seam of coal in this locality.

In No. 3 hole the Four Feet Seam is reported as including 20 in. of clean coal while the Bergin Seam comprised 1 ft. of coal and several feet of coaly shale. The interval between the Bergin and Striped Bacon Seams was abnormal—191 ft. The latter was made up of a succession of coal and shale bands. In the position where the Rob Roy Seam was expected the driller reported 7 ft. of coal, but there was no core recovery.

Coal Evaluation.

The average core recovery in coal was approximately 85 per cent., a very satisfactory figure. There was, however, a good deal of core fragmentation and consequently in building up the seam sections there has been in some cases uncertainty as to the exact position of the stone bands. Included in the samples used in the evaluation of the seams were several face samples taken from mine workings on the Four Feet and Bergin Seams. The mine samples of the Four Feet Seam agreed reasonably well in quality with those from the closest bores, but in the case of the Bergin Seam ash values of the mine samples were markedly lower than bore samples, suggesting a fairly rapid deterioration of the coal in all directions. N.S. 41 was drilled through mine pillars in the Four Feet and Bergin Seams and subsequently channel samples were cut as close as practicable to the borehole. The sections in the Four Feet Seam agreed reasonably well, though the ash in the bore sample (17·9 per cent.) was considerably lower than in the pillar sample (21·4 per cent.) due largely, no doubt, to the inclusion of a lenticular band of iron carbonate in the latter. The column of the Bergin Seam in the pillar was 1 ft. 5 in. thicker than in the borehole. As the driller insists that there could have been no loss of core and as washouts are unknown in this pit the discrepancy is most likely to be explained by faulting. A small fault was, in fact, seen in the workings, though no evidence of faulting was discernible in the core.

The coal is high volatile bituminous in rank. Moisture in unweathered samples ranged from 1·4 to 2·5 per cent. and sulphur from 0·24 to 0·41 per cent.

In estimating reserves workable coal has been assumed to extend five chains beyond the outside boreholes, unless the ash values were found to be approaching the limit of workability. The upward permissable limit of ash percentage has been arbitrarily selected as 30 per cent. and the minimum workable thickness as 2 ft. 6 in. All samples that gave an ash value in excess of 30 per cent. have been disregarded in calculating coal reserves. The estimates do not take into account pillar coal in mine workings.

Coal Reserves.

The estimates given below are for **total** measured reserves. **Available** reserves are likely to be considerably less, more particularly in the Four Feet Seam. The area is known to be crossed by two major faults and there are several small faults. This will inevitably result in loss of coal as conditions in the vicinity of the faults are not favourable for mining. In the case of the Four Feet Seam further loss will undoubtedly be occasioned by the destruction and removal of coal as a result of pre-Tertiary erosion. All the seams from the Four Feet to the Rob Roy were worked in the early days of mining on the east side of Bundamba Creek. There is no record as to the extent of the old workings, but it is known that the Four Feet and Bergin Seams are largely worked out east of the Creek. No reserves, except in the Rob Roy seam have been reckoned to exist east of Bundamba Creek.

Four Feet Seam.

The weighted average of the ash values in all the relevant samples is 22·8 per cent.; average thickness (bore cores and mine samples) is 4 ft. 8 in. and average specific gravity 1·4777. The area which is assumed to be underlain by workable coal is 203 acres. In this area the greatest vertical depth would not exceed 700 ft. Range of fixed carbon on a dry, mineral-matter free basis (calculated on the Parr Formula) is 61·1 to 65·0 per cent. with a mean value of 63·1 per cent. Measured reserves are estimated at 1,700,000 tons.

Bergin Seam.

The weighted average ash value of the eight samples that do not reach 30 per cent. is 26·2 per cent. Average thickness of these sections is 4 ft. 6 in. Average specific gravity of the coal is 1·504. Area within which reserves have been calculated is 156 acres. The greatest vertical depth of the Bergin Seam within this area would not exceed 700ft. Fixed carbon range is 61·2 to 65·1 per cent. and average fixed carbon is 63·2 per cent. Measured reserves are estimated at 1,280,000 tons.

Rob Roy Seam.

The average ash content of the eleven relevant samples (weighted for thickness) is 23·3 per cent. The average thickness of the seam as represented by these sections is 4 ft. 8 in. and the average specific gravity of the coal is 1·474. Fixed carbon ranges from 54·4* to 63·1 per cent. and averages 60·8 per cent. In the 436 acres of workable coal proved by the boring the greatest vertical depth would not exceed 900 ft. Estimated measured reserves in the Rob Roy Seam are estimated at 3,650,000 tons.

TABLE OF RESERVES.

Seam.	Average Thickness.	Average Ash.	Measured Reserves.	
			Area.	Quantity.
			Acres.	Tons.
Four Feet ..	4 ft. 8 in.	22·8	203	1,700,000
Bergin ..	4 ft. 6 in.	26·2	156	1,280,000
Rob Roy ..	4 ft. 8 in.	23·3	436	3,650,000
Total Reserves				6,630,000

* This figure is entirely abnormal. The actual analysis shows moisture 1·4%, volatile matter 33·3%, Fixed Carbon 37·1%, Ash 28·2%.

A. K. DENMEAD,
Assistant Chief Government Geologist.

A. H. TUCKER, Government Printer, Brisbane.

DEPARTMENT OF MINES QUEENSLAND

PLAN OF THE

SWANBANK LAGOON AREA
IPSWICH COALFIELD

County of Stanley
Wardens District of Ipswich

SHOWING

Boreholes, P.D.T.S. Nos.1,2 & 3 mine areas, seam outcrops, mine workings, sub-surface seam contours and areas within which reserves of coal have been estimated.

To accompany report by A.K. Denmead M.Sc. Asst. Chief Govt. Geologist Apr. 1952
From surveys by Ewan Cowley Asst. Surveyor 6/6/51
and J.O. Cuthbert B.Sc. Asst. Geologist 10/4/51.

SCALE OF CHAINS
10 8 6 4 2 0 10

SURVEY DATA

Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of Sub 1, por 213 parish of Ipswich
Elevations on State Datum by subtracting 91.24' from Railway surveys Bundamba and Bundamba - Redbank Loop
Plane table survey west of Bundamba Creek by Cuthbert and theodolite & level survey of remainder by Cowley. Grid of 10 chain co-ordinates

EXPLANATION

Borehole · Shaft · Adit · Sub-surface seam contours · A Section line A' · Seam outcrop · P.D.T.S. proposed mine areas · Fault in mine workings
Area of worked coal shown thus ..... Collieries shown thus ... THISTLE
workable coal on Bluff top section
middle
bottom
Wright Seam
Lagoon Seam
Measured reserve full line
Indicated broken

J.S. Douglas Del. 4/11/51

N.S. 27/1951 -90.40 RL surf -1094.60 RL btm
N.S. 26/1951 134.73 RL surf -745.85 RL btm
N.S. 14/1950 119.20 RL surf -810.01 RL btm
N.S. 10/1950 154.20 RL surf -844.30 RL btm
N.S. 9/1950 N.S. 16/1951 167.20 RL surf -847.80 RL btm
N.S. 17/1951 153.20 RL surf -835.80 RL btm
N.S. 11/1950 114.20 RL surf 1025.72 RL btm
N.S. 20/1951 121.20 RL surf -790.47 RL btm
N.S. 12/1950 N.S. 13/1950 133.20 RL surf -1377.50 RL btm
N.S. 18/1951 113.26 RL surf -615.65 RL btm Deflection 55°17'-69°11'
N.S. 21/1951 129.96 RL surf -790.29 RL btm
N.S. 25/1951 177.81 RL surf -457.44 RL btm
N.S. 15/1951 112.20 RL surf -1349.05 RL btm
N.S. 22/1951 126.89 RL surf -643.61 RL btm
N.S. 19/1951 114.72 RL surf -1126.28 RL btm
N.S. 24/1951 165.16 RL surf -632.17 RL btm
N.S. 23/1951 125.57 RL surf -1031.93 RL btm
TRIAL SH N.S. 1/1943 138.33 RL surf 363.67 RL btm

NO. 1 MINE AREA
NO. 2 MINE AREA
NO. 3 MINE AREA
IPSWICH
BUNDAMBA
SWANBANK
LAGOON
Bundamba Creek
Old Workings
NEW No. 5 TUNNEL
OLD No. 5 TUNNEL
ABERDARE BLUFF SEAM
ABERDARE BOTTOM SEAM
ABERDARE TOP SEAM
COMMON SECTION
WRIGHT SEAM
LAGOON SEAM
BOX FLAT EXTD No. 1 (PARKHEAD)
BOX FLAT EXTD No. 2
BOX FLAT EXTD No. 5
BOX FLAT EXTD No. 6
SOUTHERN CROSS No. 7
SOUTHERN CROSS No. 6
THISTLE No. 4
UNITED No. 5
UNITED No. 5 EXT.
SOUTHERN CROSS No. 8
Q.R. 394

LOCALITY MAP
SCALE OF MILES
25 2 1 ½ 0 2½
IPSWICH, Booval, East Ipswich, Riverview, Redbank, Bundamba, Blackstone, SWANBANK LAGOON AREA

DEPARTMENT OF MINES QUEENSLAND

PLAN OF THE

SWANBANK LAGOON AREA

IPSWICH COALFIELD

County of Stanley

Wardens District of Ipswich

SHOWING

Boreholes, P.D.T.S. Nos. 1, 2 & 3 mine areas, seam outcrops, mine workings, geology and topography.

To accompany report by A.K. Denmead M.Sc. Asst. Chief Govt. Geologist Apr. 1952

From surveys by Ewan Cowley Asst. Surveyor 6/6/51 and J.O. Cuthbert B.Sc. Asst. Geologist 10/4/51.

SCALE OF CHAINS

10 8 6 4 2 0 10

SURVEY DATA

Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of sub. l. por. 23 parish of Ipswich.

Elevations on State Datum by subtracting 91.24 from Railway surveys Bundamba and Bundamba - Redbank Loop.

Plane table survey west of Bundamba Creek by Cuthbert and theodolite & level survey of remainder by Cowley. End of 10 chain co-ordinates.

EXPLANATION

- P.D.T.S. proposed mine areas
- Established boundary – posn. accurate
- " " – " approx.
- " fault – " accurate
- Basalt – TERTIARY
- Bundamba Sandstone – UPPER TRIASSIC
- Aberdare Conglomerate – UPPER TRIASSIC
- Ipswich Coal Measures – MID-UPPER TRIASSIC
- Borehole (SH)
- Shaft
- Adit
- Outcrop
- Seam outcrop
- Contours
- Section line A'
- Collieries THISTLE
- Strike & dip

LOCALITY MAP

SCALE OF MILES

2½ 2 1½ 1 ½ 0 2½

IPSWICH
East Ipswich
Bundamba
Redbank
Riverview
Redbank Plains
Basin Pocket
Blackstone
Goodna
Woodend
Swanbank
Ripley
EWANBANK LAGOON AREA

SWANBANK LAGOON AREA

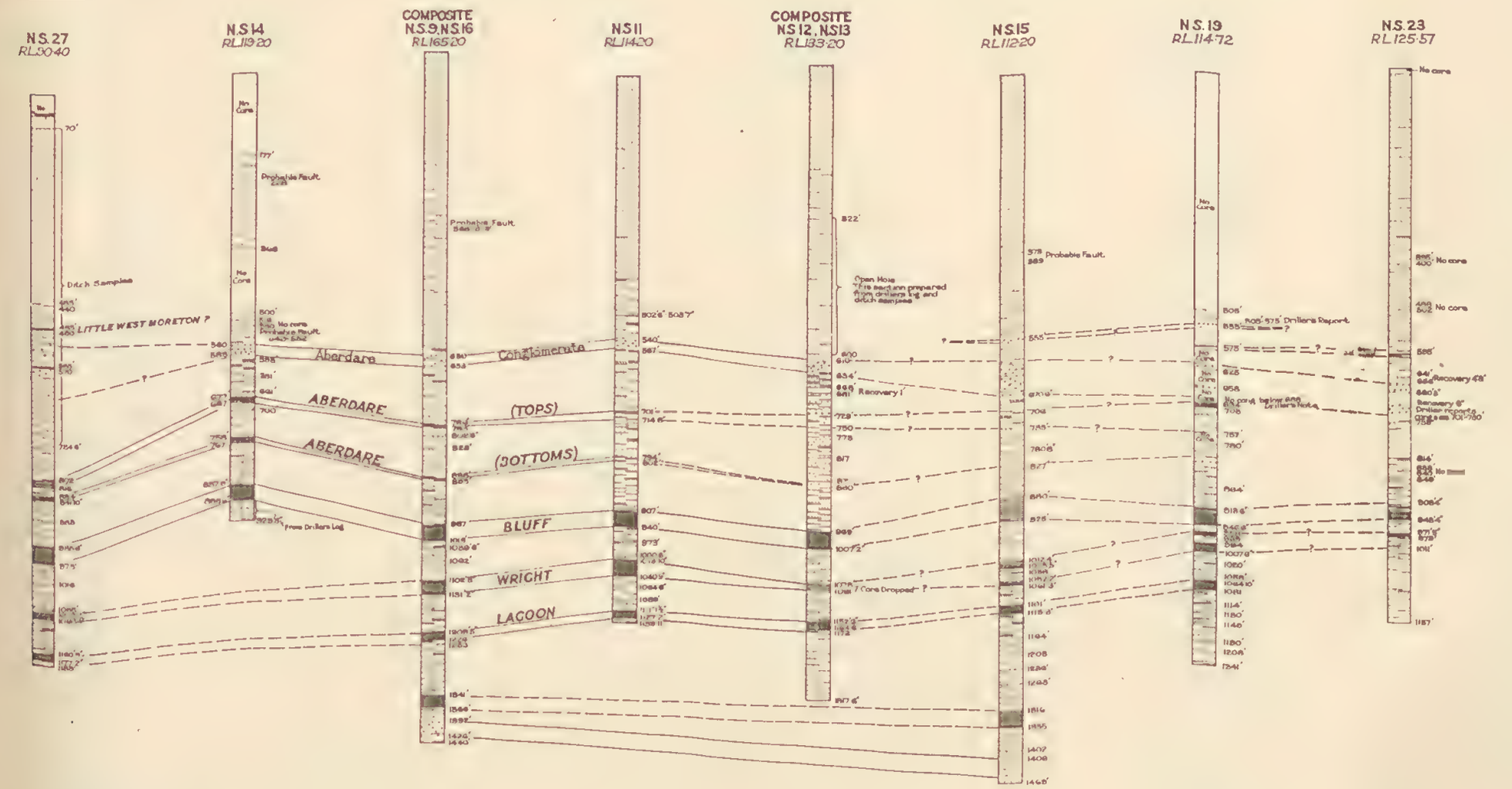
GENERALISED BORE SECTIONS

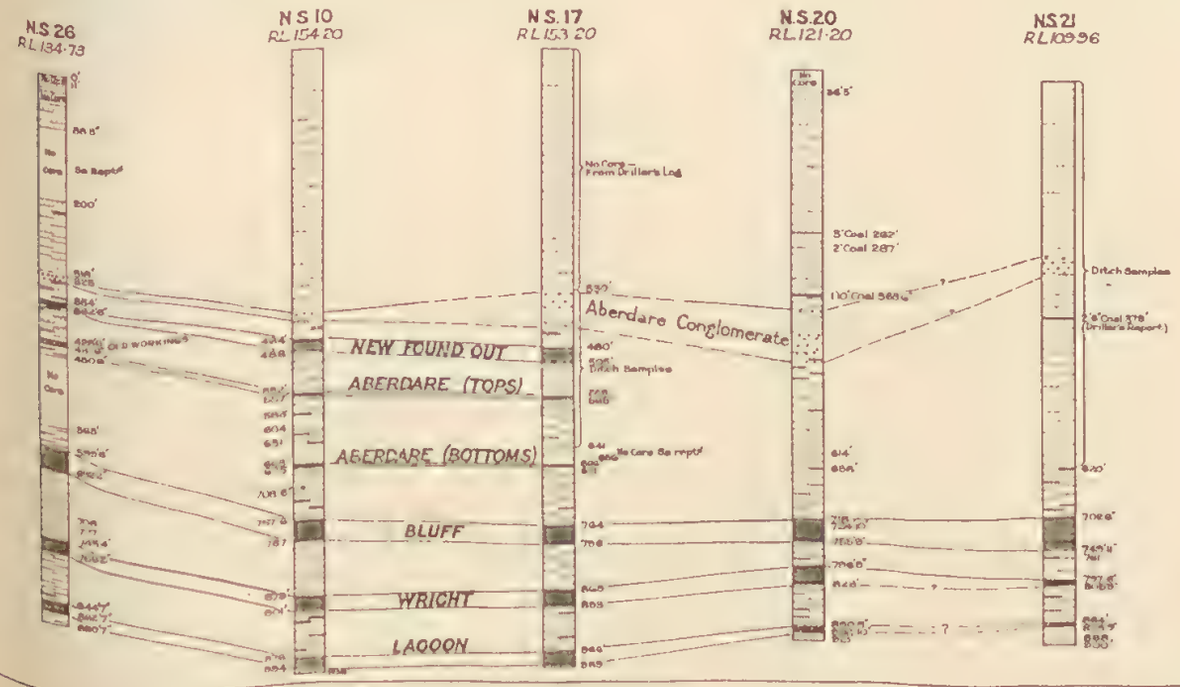
To accompany report by
A.K.DENMEAD, M.Sc., Asst. Chief Govt. Geologist

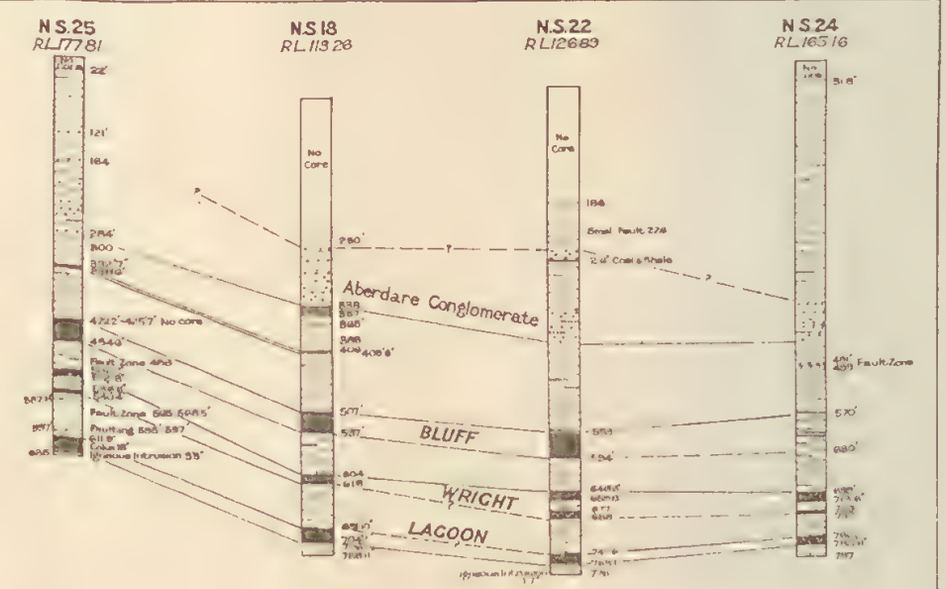
VERTICAL SCALE OF FEET

LEGEND

Sandstone	Shale
Conglomerate	Sandy Shale
Ss with occasional thin Sh bands	Interbedded Ss Sh & Sh and/or Sh
Iron Carbonate	Fault Breccia
Basalt	Coal
Coal with Shale or Sh with Coal bands	Coaly Shale







SWANBANK LAGOON AREA

CROSS SECTIONS AA'-EE'

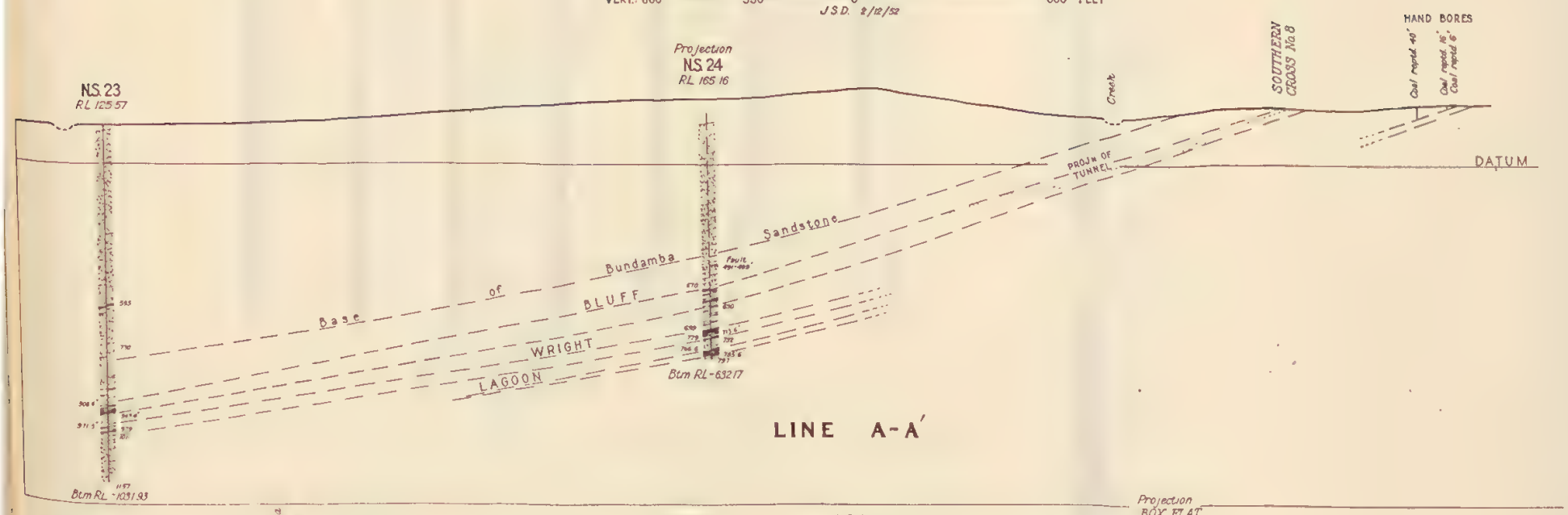
To accompany report by A.K. Denmead 15/4/52

SCALES

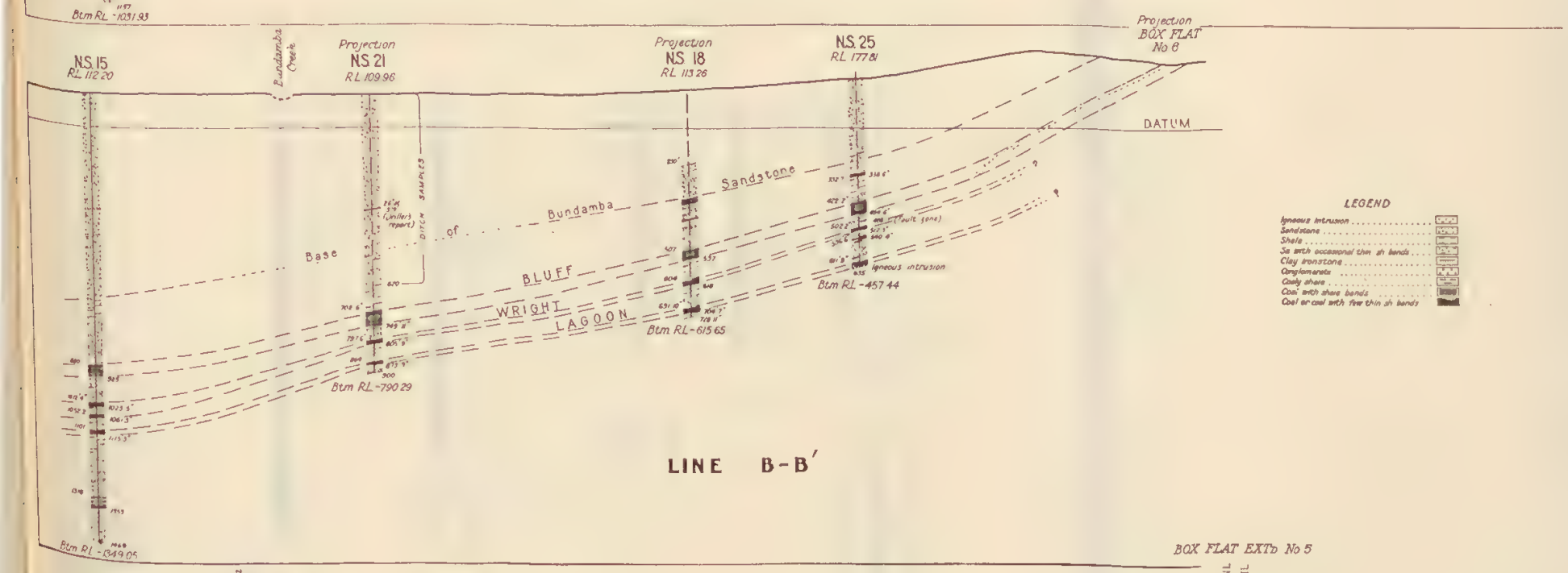
HORIZ 10 8 6 4 2 0 10 CHAINS

VERT.: 660 330 0 660 FEET

J.S.D. 2/12/52



LINE A-A'



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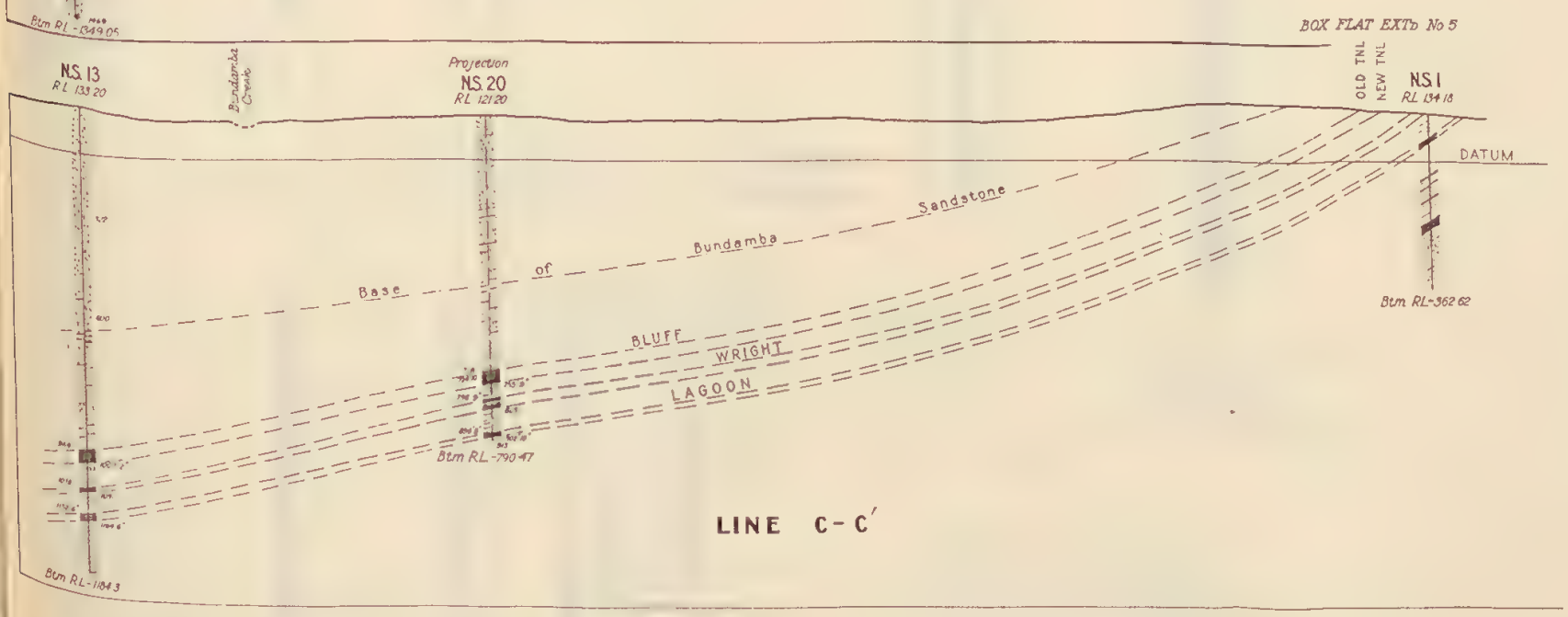
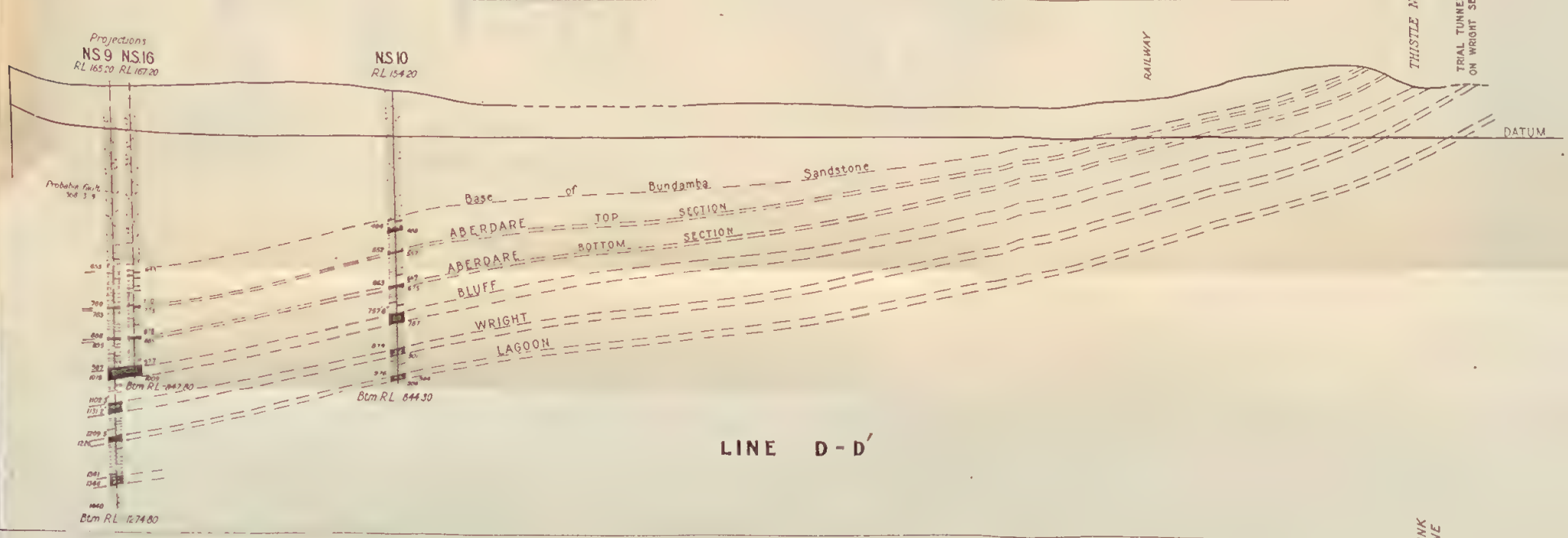
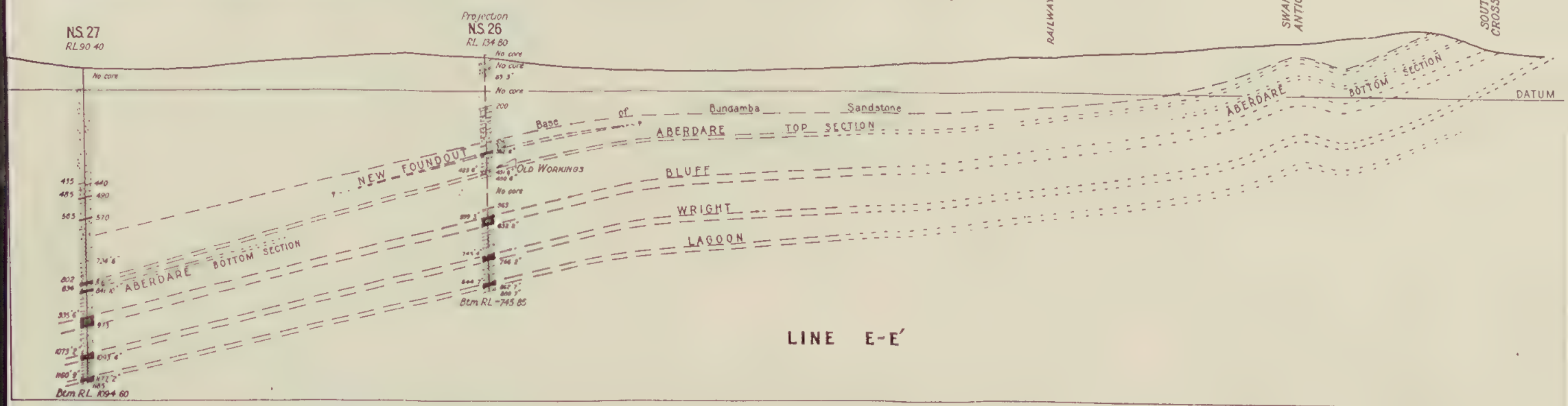


LINE C-C'



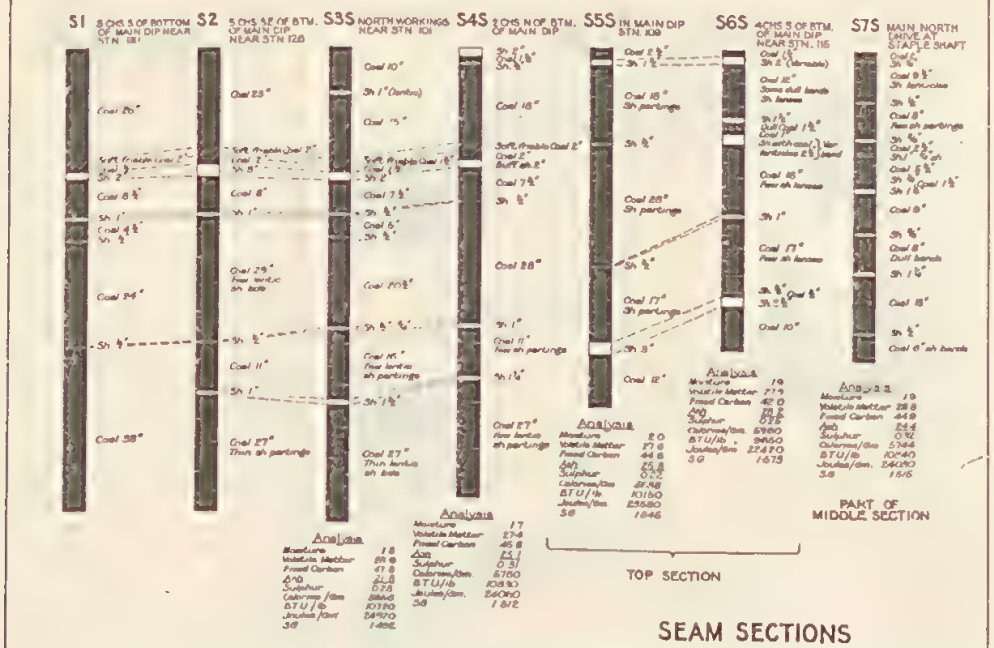
LINE D-D'



LINE E-E'

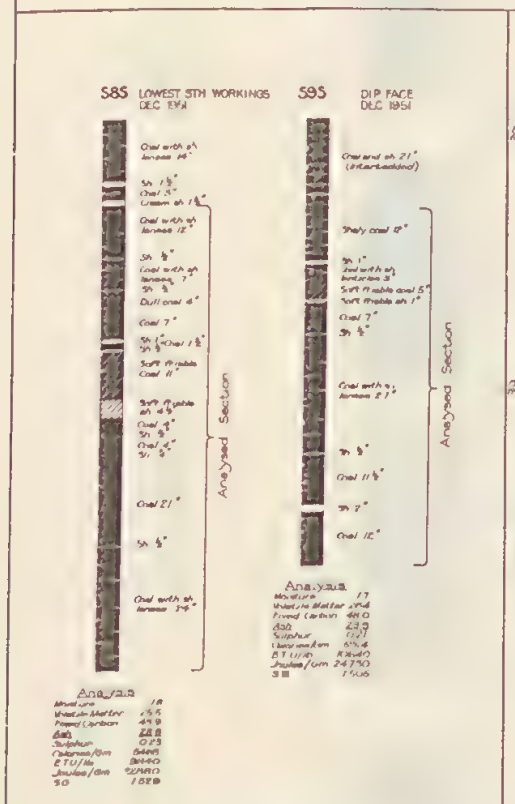
LEGEND

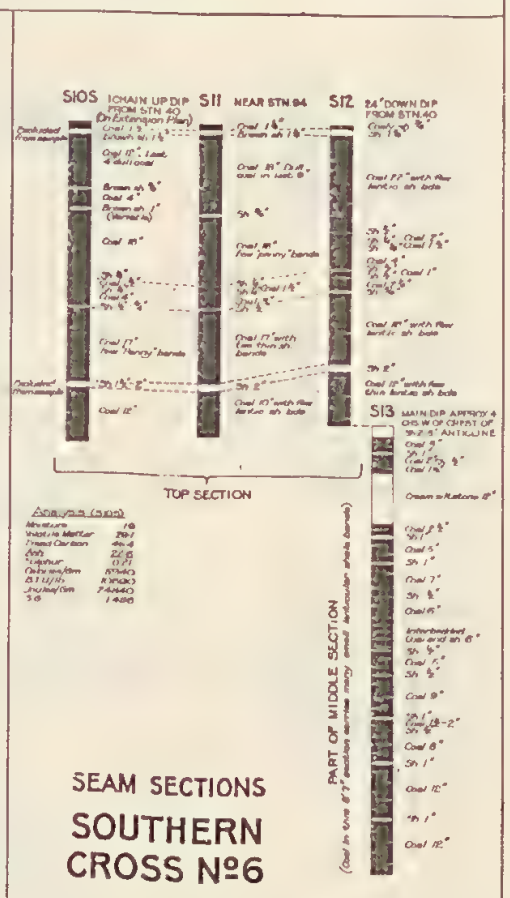
Igneous intrusion
Sandstone
Shale
Ss with occasional thin sh bands
Clay ironstone
Conglomerate
Coaly shale
Coal with shale bands
Coal or coal with few thin sh bands

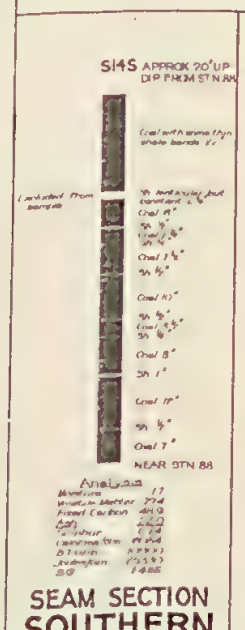


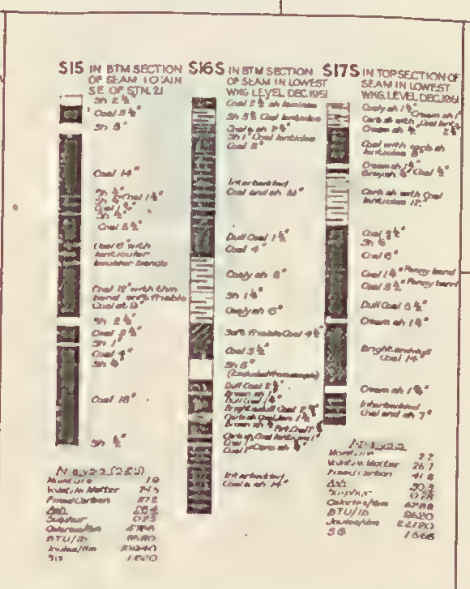
SEAM SECTIONS

BOX FLAT EXTENDED Nº 5




S10S 1CHAIN UP DIP FROM STN 40 (In Extension Plan)
S11 NEAR STN 94
S12 24' DOWN DIP FROM STN 40
S13 MAIN DIP APPROX 4 CHS W OF CREST OF 'S' AXIS ANTICLINE
TOP SECTION
PART OF MIDDLE SECTION
SEAM SECTIONS
SOUTHERN CROSS Nº6




S15 IN BTM SECTION OF SEAM 10 CHAIN SE OF STN 21
S16S IN BTM SECTION OF SEAM IN LOWEST WNG LEVEL DEC 1951
S17S IN TOP SECTION OF SEAM IN LOWEST WNG LEVEL DEC 1951
Analysis
SEAM SECTIONS
SOUTHERN CROSS Nº8

To Accompany Report by
A.K. Denmead M.Sc.
Asst. Chief Govt. Geologist
15 . 4 . 1952

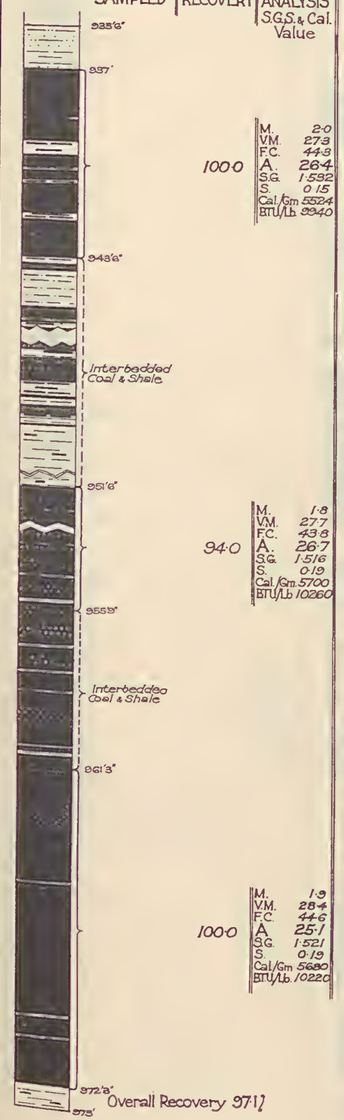
SWANBANK LAGOON AREA

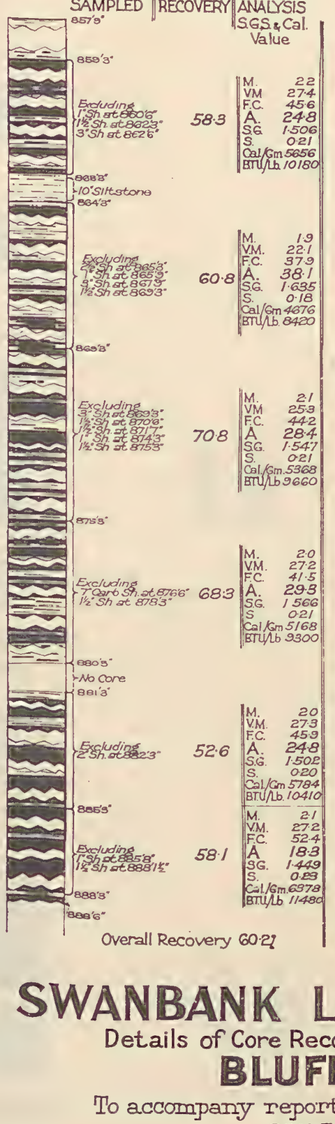
SEAM SECTIONS & COMPOSITE SECTION BLUFF SEAM

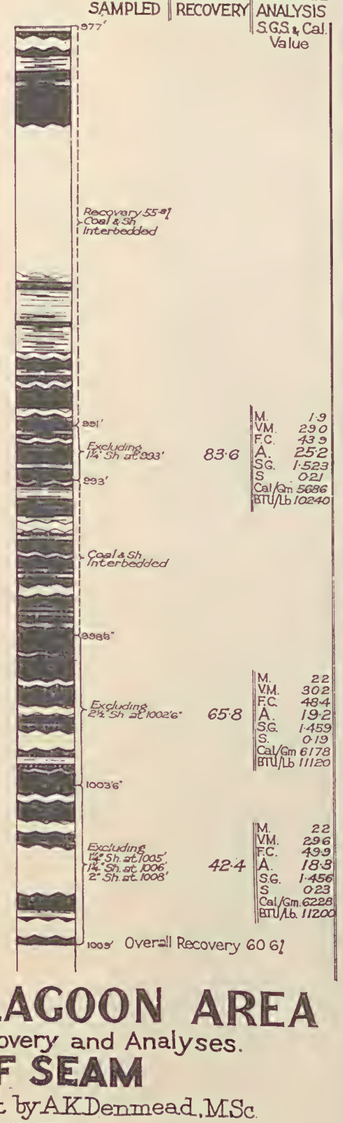
SCALE OF INCHES

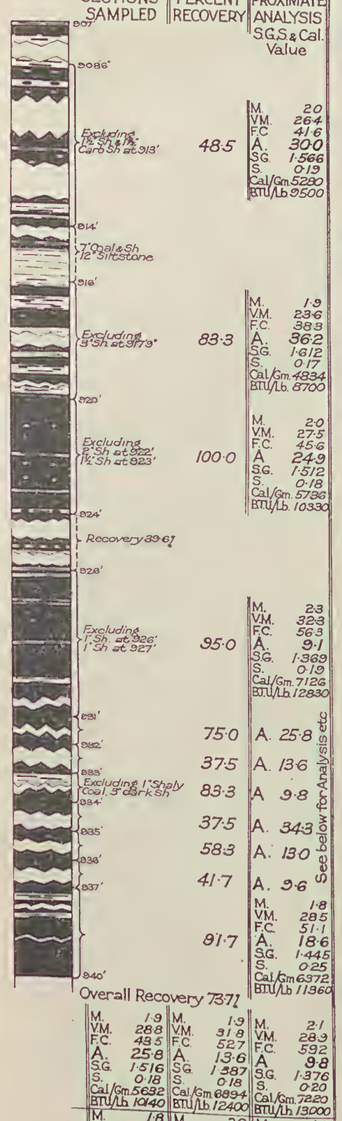
10 5 0 10 20 30 40 50

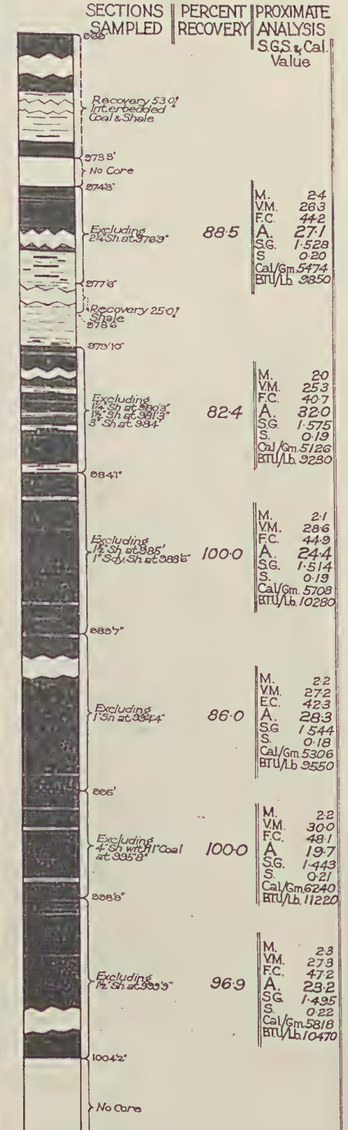
T.M.L. 27.2.53









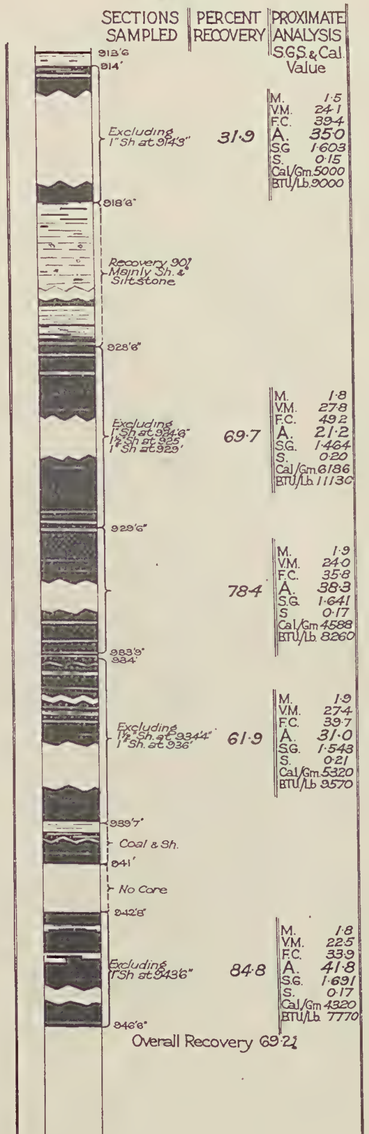


N.S. 15

Section

Workable

No



N.S. 23

Section

Workable

No

SWANBANK LAGOON AREA

Details of Core Recovery and Analyses.

BLUFF SEAM

To accompany report by A.K. Denmead, M.Sc.

SCALE OF FEET

1 0 2 4 6 8 10

15 · 4 · 1952

See below for Analysis etc

N.S. 26

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value

100%	M. 1.9 VM. 27.3 F.C. 44.0 A. 26.8 S.G. 1.529 S. 0.21 Cal/Gm. 5576 BTU/Lb. 10040
100.0	M. 2.0 VM. 27.9 F.C. 43.4 A. 26.7 S.G. 1.535 S. 0.21 Cal/Gm. 5514 BTU/Lb. 9920
100.0	M. 2.0 VM. 28.5 F.C. 47.7 A. 21.8 S.G. 1.489 S. 0.20 Cal/Gm. 5984 BTU/Lb. 10770

Overall Recovery 99.6%

N.S.10

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value

75.8	M. 2.1 VM. 25.9 F.C. 42.9 A. 29.1 S.G. 1.561 S. 0.16 Cal/Gm. 5254 BTU/Lb. 9450
66.6	M. 1.7 VM. 25.9 F.C. 42.4 A. 30.0 S.G. 1.582 S. 0.16 Cal/Gm. 5148 BTU/Lb. 9260
25.0	M. 1.9 VM. 30.1 F.C. 49.8 A. 18.2 S.G. 1.449 S. 0.17 Cal/Gm. 6308 BTU/Lb. 11360
22.0	M. 1.5 VM. 19.7 F.C. 22.0 A. 56.8 S.G. 1.884 S. 0.10 Cal/Gm. — BTU/Lb. —

Overall Recovery 50.8%

N.S.17

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value

86.9	M. 2.3 VM. 27.3 F.C. 44.2 A. 26.2 S.G. 1.518 S. 0.19 Cal/Gm. 5584 BTU/Lb. 10050
87.5	M. 2.2 VM. 28.5 F.C. 47.6 A. 22.3 S.G. 1.473 S. 0.22 Cal/Gm. 5996 BTU/Lb. 10800
82.1	M. 2.2 VM. 27.6 F.C. 42.8 A. 27.4 S.G. 1.538 S. 0.22 Cal/Gm. 5426 BTU/Lb. 9766
68.5	M. 2.2 VM. 30.6 F.C. 44.8 A. 22.4 S.G. 1.515 S. 0.21 Cal/Gm. 5764 BTU/Lb. 10370
89.3	M. 2.2 VM. 29.2 F.C. 50.3 A. 18.3 S.G. 1.450 S. 0.21 Cal/Gm. 6284 BTU/Lb. 11300

Overall Recovery 84.6%

N.S. 20

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value

71.1	M. 1.7 VM. 29.7 F.C. 47.9 A. 20.7 S.G. 1.474 S. 0.18 Cal/Gm. 6054 BTU/Lb. 10900

Overall Recovery 68.6%

N.S. 21

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value

81.1	M. 1.7 VM. 27.8 F.C. 41.0 A. 29.5 S.G. 1.544 S. 0.23 Cal/Gm. 5362 BTU/Lb. 9640
83.0	M. 1.5 VM. 28.4 F.C. 36.3 A. 33.8 S.G. 1.621 S. 0.24 Cal/Gm. 4856 BTU/Lb. 8740

Overall Recovery 73.3%

SWANBANK LAGOON AREA

Details of Core Recovery and Analyses

BLUFF SEAM

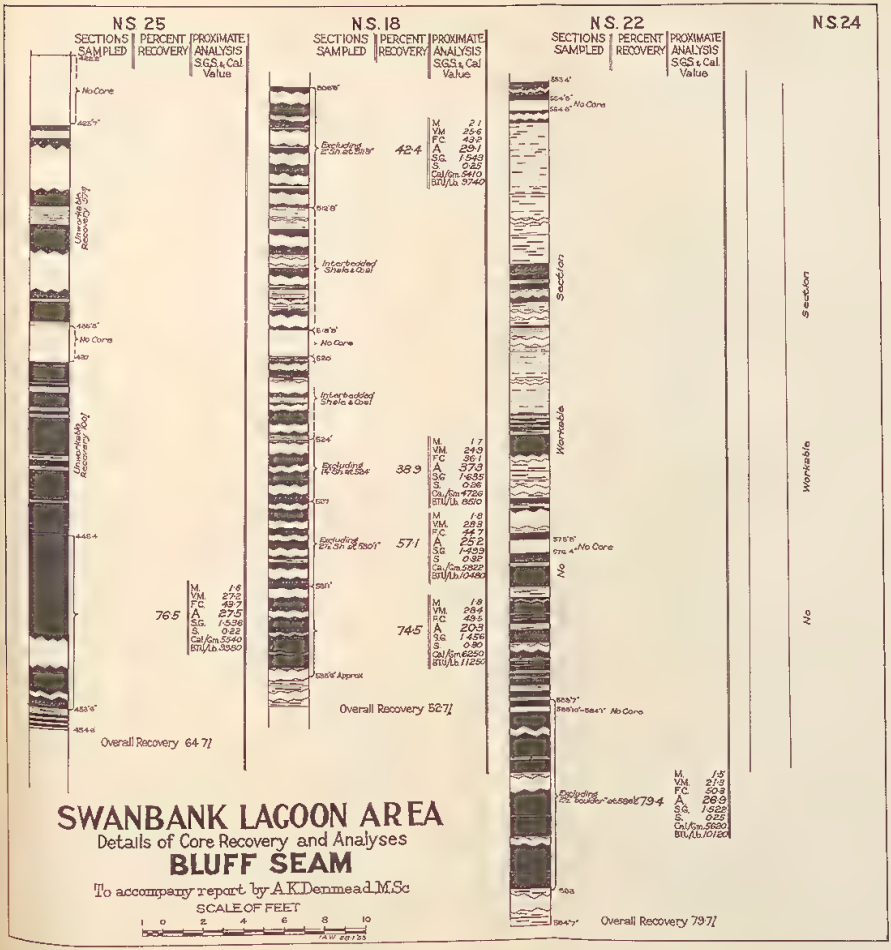
To accompany report by A.K. Denmead, M.Sc.

SCALE OF FEET

1 0 2 4 6 8 10

J.A.W. 28·1·53

15 · 4 · 1952


NS 25
SECTIONS SAMPLED
PERCENT RECOVERY
PROXIMATE ANALYSIS S.G.S. & Cal. Value
No Core
No Core
No Core
Overall Recovery 64.7%
NS.18
SECTIONS SAMPLED
PERCENT RECOVERY
PROXIMATE ANALYSIS S.G.S. & Cal. Value
Excluding 2'ch. at 518'
424
Interbedded Shale & Coal
No Core
Interbedded Shale & Coal
Excluding 8"ch. at 524'
389
Excluding 2"ch. at 530'
571
Excluding 4"ch. at 538'
745
Overall Recovery 52.7%
NS.22
SECTIONS SAMPLED
PERCENT RECOVERY
PROXIMATE ANALYSIS S.G.S. & Cal. Value
No Core
No Core
No Core
Excluding 2½" boulder at 558'
794
Overall Recovery 79.7%
NS.24
Section
Workable
No
SWANBANK LAGOON AREA
Details of Core Recovery and Analyses
BLUFF SEAM
To accompany report by A.K.Denmead M.Sc
SCALE OF FEET
0 2 4 6 8 10

N.S. 27

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G. S. & Cal. Value

1073'2"

63·4

M. 1·6
V.M. 25·3
E.C. 35·6
A. 37·5
S.G. 1·667
S. 0·15
Cal/gm. 4500
B.T.U/lb. 8100

1081'7"

1093'4"

Overall recovery: 74·8%

N.S. 9

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G. S. & Cal. Value

1102'3"

No core

1106'3"

59·2

M. 1·7
V.M. 28·2
E.C. 50·6
A. 19·5
S.G. 1·481
S. 0·28
Cal/gm. 6348
B.T.U/lb. 11430

1109'3"

13·3

M. 1·7
V.M. 26·6
E.C. 42·2
A. 29·5
S.G. 1·569
S. 0·29
Cal/gm. 5482
B.T.U/lb. 9870

1112'

41·7

1121'2"

1131'2"

Overall recovery: 51·6%

N.S. 11

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G. S. & Cal. Value

1013'10"

1014'11"

Excluding 2" shale at 1023'10"
A: 66·4
S.G: 2·074

76·9

M. 1·9
V.M. 29·5
E.C. 48·6
A. 20·0
S.G. 1·449
S. 0·22
Cal/gm. 6196
B.T.U/lb. 11150

1025'

1040'9"

Overall recovery: 87·9 %

N.S. 12

N.S. 15

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G. S. & Cal. Value

1012'4"
1012'6"

54·3

M. 1·7
V.M. 26·3
E.C. 48·1
A. 23·9
S.G. 1·496
S. 0·20
Cal/gm. 5930
B.T.U/lb. 10670

1016'4"

Excluding 1" shale at 1018'8"

45·9

M. 1·6
V.M. 25·6
E.C. 39·5
A. 33·3
S.G. 1·581
S. 0·20
Cal/gm. 5106
B.T.U/lb. 9190

1021'5"

TOP SECTION OF WRIGHT SEAM

1023'5"

Overall recovery: 55·3%

Shale, sdy. sh. & sandstone

1052'2" BOTTOM SECTION OF WRIGHT SEAM

Interbedded coal & shale
Recovery 85·8%

1061'3"

N.S. 19

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G. S. & Cal. Value

958' 958'3"

63·7

M. 1·9
V.M. 24·8
E.C. 45·6
A. 27·7
S.G. 1·539
S. 0·19
Cal/gm. 5518
B.T.U/lb. 9930

965'3"

TOP SECTION OF WRIGHT SEAM

969'

Overall recovery: 72·3%

Shale & sandy shale

994'

Interbedded shale & coal

BOTTOM SECTION OF WRIGHT SEAM
Recovery approx. 100 %

1006'

N.S. 23

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G. S. & Cal. Value

971'5"

53·2

M. 1·8
V.M. 25·2
E.C. 41·4
A. 31·6
S.G. 1·587
S. 0·18
Cal/gm. 5134
B.T.U/lb. 9240

977'3"

TOP SECTION OF WRIGHT SEAM

979'

Overall recovery: 61·8%

Shale & sandy shale

? 988'8"

Interbedded shale & coal
Recovery 4·8%

? 999'

BOTTOM SECTION OF WRIGHT SEAM

SWANBANK LAGOON AREA

DETAILS OF CORE RECOVERY AND ANALYSES

WRIGHT SEAM

To accompany report by A.K.Denmead M.Sc., 15th. April, 1952.

SCALE OF FEET
8 6 4 2 0 2 4 6 8

J.S.D. 6·2·53

N.S. 26

SECTIONS SAMPLED: 745'4" – 746'1" ; 750'4½" – 767'3"

PERCENT RECOVERY: 100

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·9
V.M.	27·3
F.C.	42·8
A	28·0
S.G.	1·534
S.	0·19
Cal/gm.	5486
B.T.U/lb.	9870

Overall recovery: 99·3 %

N.S. 10

SECTIONS SAMPLED: 879' – 880' ; 886' – 889' ; 901'3"

PERCENT RECOVERY: 62·5

PROXIMATE ANALYSIS S.G., S. & Cal Value

M.	1·8
V.M.	26·7
F.C.	42·8
A.	28·7
S.G.	1·573
S.	0·27
Cal/gm.	5490
B.T.U/lb.	9880

Only 4" core

Interbedded coal and shale Recovery 66·6 %

Overall recovery: 51·3 %

N.S. 17

SECTIONS SAMPLED: 868'9" – 877'4" ; 878'6" – 882'8" ; 892'

PERCENT RECOVERY: 49·5 ; 100 ; Recovery 69 %

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·8	M.	1·6
V.M.	25·7	V.M.	24·6
F.C.	44·1	F.C.	35·4
A	28·4	A.	38·4
S.G.	1·541	S.G.	1·645
S.	0·21	S.	0·17
Cal/gm.	5530	Cal/gm.	4634
B.T.U/lb	9950	B.T.U/lb.	8340

Overall recovery: 66·8 %

N.S. 20

SECTIONS SAMPLED: 796'9" – 805'9" ; Inferior coal, sh. & carb. sh. continue to 822'7"

PERCENT RECOVERY: 63·2

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M	1·5
V.M.	28·7
F.C.	45·6
A.	24·2
S.G.	1·496
S.	0·14
Cal/gm.	5796
B.T.U/lb.	10430

Overall recovery: 79·8 %

N.S. 21

SECTIONS SAMPLED: 797'6" – 798'10" ; 805'9" – 809'

PERCENT RECOVERY: 67·5

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·5
V.M.	27·7
F.C.	50·2
A.	20·6
S.G.	1·468
S	0·24
Cal/gm.	6142
B.T.U/lb.	11060

Shale with coal lenticles

Overall recovery: 69 %

SWANBANK LAGOON AREA

Details of core recovery and analyses

WRIGHT SEAM

To accompany report by A K. Denmead, M. Sc., 15th. April, 1952

SCALE OF FEET 8 6 4 2 0 2 4 6 8

J. S. D. 4·1·53

N.S. 25

SECTIONS SAMPLED: 502'2" – 506'7"

PERCENT RECOVERY: 66·0

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·7
V.M.	26·7
F.C.	46·6
A.	24·8
S.G.	1·501
S.	0·26
Cal/gm.	5808
B.T.U./lb.	10460

TOP SECTION OF WRIGHT SEAM

Overall recovery : 83·5%

BOTTOM SECTION OF WRIGHT SEAM

Begins at 534'4" and extends to 542'7".

Interbedded coal and shale.

N.S. 18 (DEFLECTION)

SECTIONS SAMPLED: 603'7 – 609'

PERCENT RECOVERY: 69·2

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·8
V.M.	27·6
F.C.	51·9
A.	18·7
S.G.	1·466
S.	0·24
Cal/gm.	6386
B.T.U./lb.	11490

617'5"

Overall recovery : 62·3%

N.S. 22

SECTIONS SAMPLED: 646'7" – 653'1"

PERCENT RECOVERY: 100

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·5
V.M.	28·0
F.C.	48·9
A.	21·6
S.G.	1·478
S.	0·24
Cal/gm.	6048
B.T.U./lb.	10880

SECTIONS SAMPLED: 653'1" – 659'6"

PERCENT RECOVERY: 100

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·3
V.M.	24·3
E.C.	34·1
A.	40·3
S.G.	1·666
S.	0·27
Cal/gm.	4400
B.T.U./lb.	7920

659'6"

Overall recovery : 100%

Shale & sdy. sh.

BOTTOM SECTION OF WRIGHT SEAM

Begins at 677' and extends to 688'.

Banded shale and coal.

N.S. 24

SECTIONS SAMPLED: 699'5½" – 704'9¾"

PERCENT RECOVERY: 81·6

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M.	1·6
V.M.	26·6
F.C.	46·1
A.	25·7
S.G.	1·553
S.	0·22
Cal/gm.	5724
B.T.U./lb.	10300

704'9¾" – 704'11¼"

SECTIONS SAMPLED: 704'11¼" – 708'6"

PERCENT RECOVERY: 100

PROXIMATE ANALYSIS S.G., S. & Cal. Value

M	1·6
V.M.	27·7
F.C.	39·7
A	31·0
S.G.	1·588
S.	0·22
Cal/gm.	5156
B.T.U./lb.	9280

708'6"

TOP SECTION OF WRIGHT SEAM

Overall recovery : 95·8%

Shale with coal bands

BOTTOM SECTION OF WRIGHT SEAM

Begins at 729', extends to approx. 742'. Recovery 78·2%.

Banded coal and shale.

SWANBANK LAGOON AREA

Details of core recovery and analyses

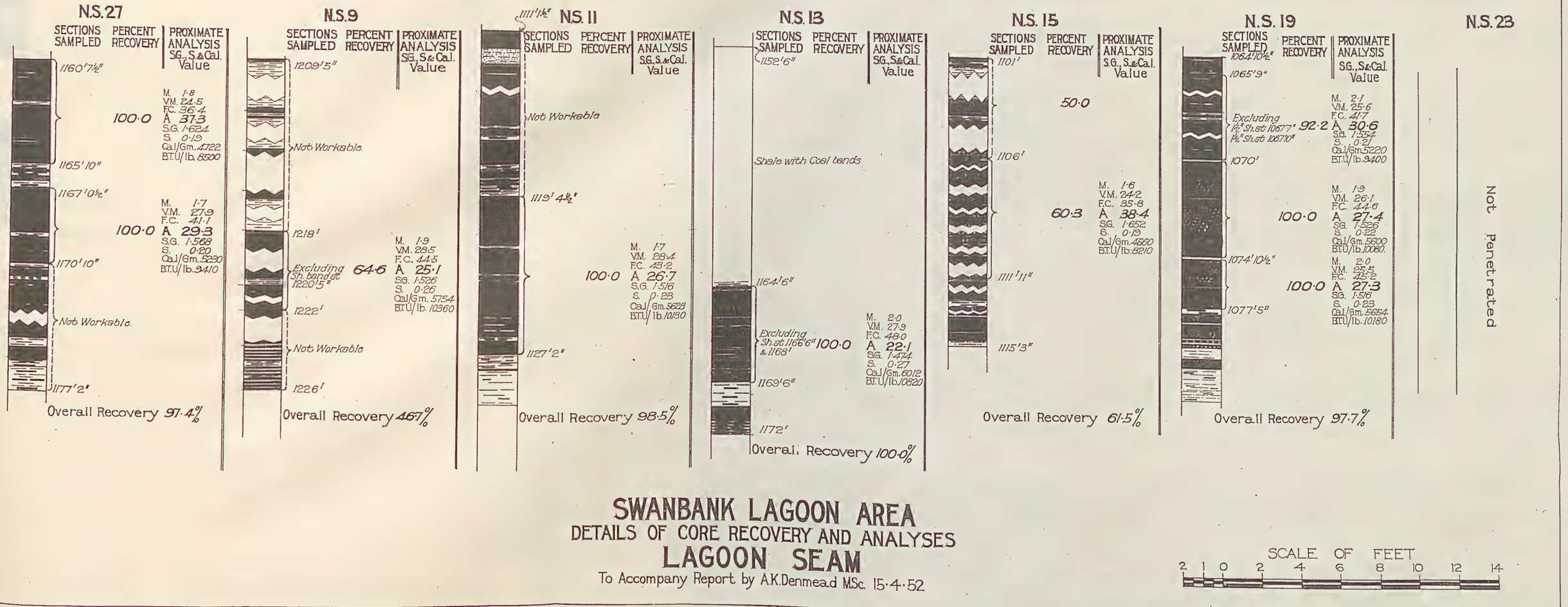
WRIGHT SEAM

To accompany report by A. K. Denmead, M.Sc., 15th. April, 1952.

SCALE OF FEET

8 6 4 2 0 2 4 6 8

J.S.D. 28·1·53



SWANBANK LAGOON AREA

DETAILS OF CORE RECOVERY AND ANALYSES

LAGOON SEAM

To Accompany Report by A.K. Denmead M.Sc. 15·4·52

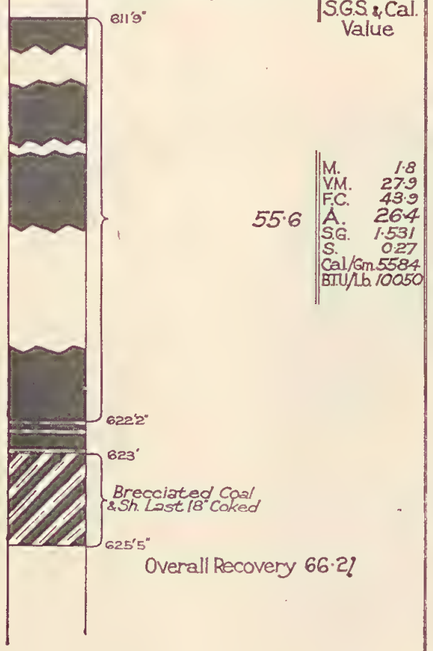
SCALE OF FEET

2 1 0 2 4 6 8 10 12 14

L.P.H. 19·1·53

N.S. 25

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value



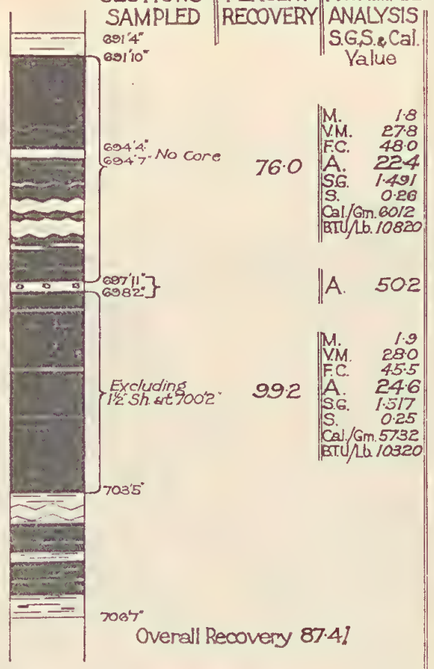
55·6

M. 1·8
V.M. 27·9
F.C. 43·9
A. 26·4
S.G. 1·531
S. 0·27
Cal/Gm. 5584
BTU/Lb. 10050

Overall Recovery 66·2%

N.S. 18

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value



76·0

M. 1·8
V.M. 27·8
F.C. 48·0
A. 22·4
S.G. 1·491
S. 0·26
Cal/Gm. 6012
BTU/Lb. 10820

A. 50·2

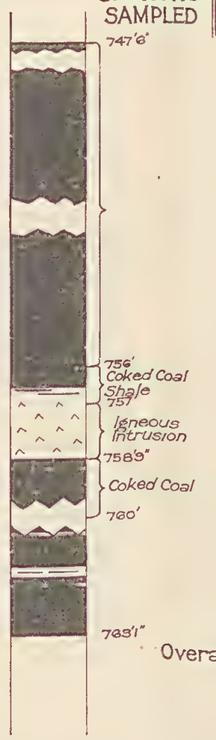
99·2

M. 1·9
V.M. 28·0
F.C. 45·5
A. 24·6
S.G. 1·517
S. 0·25
Cal/Gm. 5732
BTU/Lb. 10320

Overall Recovery 87·4%

N.S. 22

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.S. & Cal. Value



78·4

M. 1·6
V.M. 27·6
F.C. 44·7
A. 26·1
S.G. 1·514
S. 0·25
Cal/Gm. 5644
BTU/Lb. 10160

Overall Recovery 83·5%

N.S. 24

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS S.G.,S. & Cal Value

100·0

M. 1·8
V.M. 27·1
F.C. 44·7
A. 26·4
S.G. 1·522
S. 0·22
Cal/Gm. 5588
BTU/Lb. 10060

Overall Recovery 84·9%

SWANBANK LAGOON AREA

Details of Core Recovery and Analyses

LAGOON SEAM

To accompany report by A.K. Denmead, M.Sc.

15 · 4 · 52

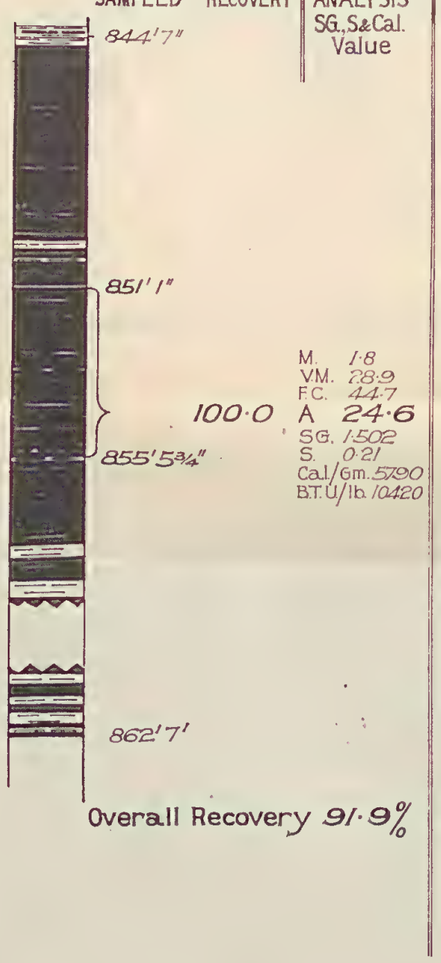
SCALE OF FEET

1 0 1 2 3 4 5 6 7 8 9 10

J.A.W. 4·2·52

N.S. 26

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS SG., S&Cal. Value



100·0

M. 1·8
V.M. 28·9
F.C. 44·7
A. 24·6
SG. 1·502
S. 0·21
Cal/Gm. 5790
BT.U/lb. 10420

Overall Recovery 91·9%

N.S. 10

SECTION WORKABLE Recovery

POSSIBLY Insufficient

N.S. 17

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS SG., S&Cal. Value

100·0

M. 1·8
V.M. 28·5
F.C. 43·5
A. 26·2
SG. 1·507
S. 0·28
Cal/Gm. 5748
BT.U/lb. 10330

Overall Recovery 89·5%

N.S. 20

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS SG., S&Cal Value

45·0

87·9

M. 1·6
V.M. 27·0
F.C. 41·3
A. 30·1
SG. 1·567
S. 0·24
Cal/Gm. 5320
BT.U/lb. 9570

Overall Recovery 63·4%

N.S. 21

SECTIONS SAMPLED | PERCENT RECOVERY | PROXIMATE ANALYSIS SG., S&Cal. Value

87·5

M. 1·5
V.M. 24·6
F.C. 34·7
A. 39·2
SG. 1·653
S. 0·21
Cal/Gm. 4446
BT.U/lb. 8060

Overall Recovery 82·1%

SWANBANK LAGOON AREA

DETAILS OF CORE RECOVERY AND ANALYSES

LAGOON SEAM

To Accompany Report by A.K. Denmead M.Sc. 15·4·52

SCALE OF FEET

2 1 0 2 4 6 8 10 12

L.P.H. 29·1·53

DEPARTMENT OF MINES QUEENSLAND

PLAN OF

P.D.T.S. Nos. 7 & 8 MINE AREAS
BUNDAMBA
IPSWICH COALFIELD

County of Stanley · Warden's District of Ipswich

Showing P.D.T.S. Mine Areas, boreholes, mine workings and areas within which reserves have been estimated.

To accompany report by A.K. Denmead M.Sc., Asst. Chief Govt. Geol., Nov 1952.

Survey by Ewan Cowley Asst. Surveyor, July 1952

SCALE OF CHAINS

10 8 6 4 2 0 10 20

SURVEY DATA

Meridian of grid is true North at origin an arbitrary point being bolt in concrete block on road near angle in Eastern bdy. of sub. 1, Por. 213, Parish of Ipswich

Elevations on State Datum by subtracting 91.24 feet from Railway Surveys Bundamba & Redbank-Bundamba Loop

Grid of 10 chain co-ordinates

EXPLANATION

P.D.T.S. proposed Mine Areas · Borehole · Shaft · Adit · A Section Line A

Fault in mine workings ------ Collieries ABERDARE No.6, abandoned WALLSEND A

Present limit of Aberdare No.8 workings shown thus ... No.6 ... Area of measured reserves on Four Feet Seam ... Bergin ... Rob Roy

LOCALITY MAP

SCALE OF MILES

J.S.D. 4/8/53

DEPARTMENT OF MINES QUEENSLAND

Geological Map

P.D.T.S. Nos. 7 & 8 MINE AREAS
BUNDAMBA
IPSWICH COALFIELD

County of Stanley · Warden's District of Ipswich
Showing P.D.T.S mine areas, geology, topography and boreholes
To accompany report by A.K.Denmead M.Sc.
Surface geology by J.O.Cuthbert B.Sc.
Topographical survey by Ewan Cowley

SCALE OF CHAINS 0 8 6 4 2 0 10 20

10 chain grid on true North. Elevations in feet on State Datum

EXPLANATION

- P.D.T.S. proposed Mine Areas
- Adit
- Seam outcrop
- Borehole
- Shaft
- Sandstone outcrop
- Tertiary Sediments
- " Basalts
- Aberdare Conglomerate
- Ipswich Coal Measures
- Blackstone Beds
- Cooneane Beds
- Fault as mapped
- " projd to surf from mine wkgs.
- Contours
- Section line A—A

J.S.D. 8-5-54

N.S. 36
R.L. Surf. 54.93'
F.F. Seam Eroded

N.S. 33
R.L. Surf. 52.05'
F.F. Seam Eroded

N.S. 44
R.L. Surf. 63.25'

N.S. 38
R.L. Surf. 109.45'
R.L.F.F. -385'

N.S. 37
R.L. Surf. 80.16'
R.L.F.F. -308'

N.S. 41
R.L. Surf. 63.57'
R.L.F.F. -22'

N.S. 39
N.S. 40
R.L. Surf. 79.97'

Old Bore
R.L. Surf. 92'
R.L.F.F. -421'

N.S. 34
R.L. Surf. 110.16'
R.L.F.F. -533'

N.S. 29
R.L. Surf. 68.40'
R.L.F.F. -299'

N.S. 35
R.L. Surf. 71.76'
R.L.F.F. -398'

N.S. 28
R.L. Surf. 60.50'
R.L.F.F. -87'

Q'ld Ind. N°4
R.L. Surf. 112.12'

N.S. 31
R.L. Surf. 64.02'
R.L.F.F. -622'

N.S. 32
R.L. Surf. 63.80'
R.L.F.F. -416'

Bundamba

Q'ld Ind. N°7
R.L. Surf. 131.36'

Q'ld Ind. N°3
R.L. Surf. 100.03'
R.L.F.F. -387'

Q'ld Ind. N° 2
R.L. Surf. 164.40'
R.L.F.F. -26'

PDTS. N°s 7 & 8 MINE AREAS BUNDAMBA

SKELETON PLAN

SHOWING

STRUCTURE CONTOURS

FOUR FEET SEAM

To accompany report by A.K. Denmead, M.Sc. Dec. 52
Contours plotted by J.O. Cuthbert, B.Sc.

SCALE OF CHAINS 4 3 2 1 0 4 8 12

J.A.W. 88-7-52

Contours drawn on base of Seam at 50' intervals
All levels referred to State Datum
Contours above ground level shown as dotted line

N.S. 36
R.L. Top 54.93
R.L.B. -343
(No split in Bergin)

N.S. 33
R.L. Top 52.05
R.L.B. -194
(No split in Bergin)

N.S. 42/44
R.L. Top 63.24
R.L.B. -46
(No split in Bergin)

N.S. 38
R.L. Top 109.45
R.L.B. -483
(No split in Bergin)

N.S. 37
R.L. Top 80.46
R.L.B.T. -395

N.S. 41
R.L. Top 63.57
R.L.B.T. -281

N.S. 39
N.S. 40
R.L. Top 79.97

Old Bore
R.L. Top 92
R.L.B.T. -432

N.S. 34
R.L. Top 110.16
R.L.B.T. -600

N.S. 29
R.L. Top 68.40
R.L.B.T. -351

N.S. 35
R.L. Top 71.78
R.L.B.T. -444

N.S. 28
R.L. Top 60.50
R.L.B.T. -173

Q'ld Ind. N°4
R.L. Top 112.12

N.S. 32
R.L. Top 63.80
R.L.B.T. -454

N.S. 31
R.L. Top 64.02
R.L.B.T. -658

Bundamba Creek

Q'ld Ind N°7
R.L. Top 131.36

Old. Ind. N°3
R.L. Top 100.03
R.L.B.T. -428

Q'ld Ind. N°2
R.L. Top 164.40
(Correlation Uncertain)

PDTS. N°s 7 & 8 MINE AREAS, BUNDAMBA.

SKELETON PLAN

SHOWING

STRUCTURE CONTOURS

BERGIN SEAM (Top Section)

To accompany report by A.K. Denmead, M.Sc., Dec., 53.
Contours plotted by J.O. Cuthbert, B.Sc.

SCALE OF CHAINS
4 3 2 1 0 4 8 12
J.A.W. 12.6.53

Contours drawn on base of Seam at 50' intervals
All levels referred to State Datum
Contours above ground level shown as dotted line

P.D.T.S. Nos 7 & 8 MINE AREAS, BUNDAMBA

SKELETON PLAN

SHOWING

STRUCTURE CONTOURS

STRIPED BACON SEAM

To accompany report by A.K. Dermead, M.Sc., Dec '52

Contours plotted by J.O. Cuthbert, B.Sc.

SCALE OF CHAINS

0 4 8 12

J.A.W. 23.4.53

Contours drawn on base of Seam at 50' intervals
All levels referred to State Datum
Contours above ground level shown as dotted line

N.S. 36 R.L. Top 54.99' R.L.S.B. -420'

N.S. 33 R.L. Top 52.05' R.L.S.B. -249'

N.S. 44 R.L. Top 64.25' R.L.S.B. -135'

N.S. 38 R.L. Top 109.45' R.L.S.B. -575'

N.S. 37 R.L. Top 80.46 R.L.S.B. -475'

N.S. 41 R.L. Top 63.57' R.L.S.B. -397'

N.S. 39 N.S. 40 R.L. Top 79.97' R.L.S.B. +24'

Old Bore R.L. Top 92'

N.S. 34 R.L. Top 110.16' R.L.S.B. -774'

N.S. 29 R.L. Top 69.49' R.L.S.B. -477'

N.S. 35 R.L. Top 71.76' R.L.S.B. -563'

N.S. 28 R.L. Top 60.50' R.L.S.B. -279'

Q'ld Ind N°4 R.L. Top 112.12'

N.S. 31 R.L. Top 64.02' R.L.S.B. -866'

N.S. 32 R.L. Top 63.8' R.L.S.B. -638'

Bundamba Creek

Q'ld Ind N°7 R.L. Top 131.86

Q'ld Ind N°3 R.L. Top 100.03' R.L.S.B. -679'

Q'ld Ind N°2 R.L. Top 64.20 R.L.S.B. -241'

-50' -100' -150' -200' -250' -300' -350' -400' -450' -500' -550' -600' -650' -700' -750' -800' -850'

220 N. 210 N. 200 N. 190 N. 180 N. 170 N. 160 N. 150 N. 140 N. 130 N. 120 N.

20 W. 10 W. 0 10 E. 20 E. 30 E. 40 E. 50 E. 60 E.

N.S. 36
R.L. Top 54.93
R.L. RR -450'

N.S. 33
R.L. Top 52.05
R.L. RR -235'

N.S. 42
R.L. Top 65.25
R.L. RR -178'

N.S. 44

N.S. 38
R.L. Top 109.45
R.L. RR -606'

N.S. 37
R.L. Top 80.46
R.L. RR -508'

N.S. 41
R.L. Top 63.57
R.L. RR -434'

N.S. 39
N.S. 40
R.L. Top 79.97
R.L. RR -13'

Old Bore
R.L. Top 92'
R.L. RR (below b'tm of bore)

N.S. 34
R.L. Top 110.16'
R.L. RR -698.84'

N.S. 29
R.L. Top 68.40'
R.L. RR -506'

N.S. 35
R.L. Top 71.76'
R.L. RR -622'

N.S. 28
R.L. Top 60.50'
R.L. RR -313'

Q'l'd. Ind. N°4
R.L. Top 112.12'
R.L. RR (below b'tm of bore)

N.S. 32
R.L. Top 63.80'
R.L. RR -672'

N.S. 31
R.L. Top 64.02
R.L. RR -682

Q'l'd Ind N°7
R.L. Top 131.36'
R.L. RR -19'(?)

Q'l'd Ind N°3
R.L. Top 100.03
R.L. RR. -673

Q'l'd Ind N°2
R.L. Top 164.40
R.L. RR -276'

Bundamba Creek

P.D.T.S. N°s 7 & 8 MINE AREAS, BUNDAMBA
SKELETON PLAN
SHOWING
STRUCTURE CONTOURS
ROB ROY SEAM

To accompany report by A.K. Denmead M.Sc. Dec. '32
Contours plotted by J.O. Cuthbert, B.Sc.

SCALE OF CHAINS
4 2 2 1 0 4 8 12
J.A.W. 14.5.33

Contours drawn on base of Seam at 50' intervals
All levels referred to State Datum
Contours above ground level shown as dotted line

N.S. 36
R.L. Surf. 54·93
R.L. Pre-T. Surf. -265'

N.S. 33
R.L. Surf. 52·05
R.L. Pre-T. Surf. -98'

N.S. 42
R.L. Surf. 62·43

N.S. 44
R.L. Surf. 63·25'

N.S. 38
R.L. Surf. 109·45'
R.L. Pre-T. Surf. -294'

N.S. 37
R.L. Surf. 80·46'
R.L. Pre-T. Surf. -291'

N.S. 41
R.L. Surf. 63·57'
R.L. Pre-T. Surf. -65'

N.S. 39
N.S. 40
R.L. Surf. 79·97'

-300'
-250'
-200'
-150'
-100'
-50'
-0'

Old Bore
R.L. Surf. 92'
R.L. Pre-T. Surf. -237'

N.S. 34
R.L. Surf. 110·16'
R.L. Pre-T. Surf. -302'

N.S. 29
R.L. Surf. 68·40'
R.L. Pre-T. Surf. -180'

N.S. 35
R.L. Surf. 71·76'
R.L. Pre-T. Surf. -222'

N.S. 28
R.L. Surf. 60·50'
R.L. Pre-T. Surf. +10'

Old. Ind. N°4
R.L. Surf. 112·12'

Creek

N.S. 31
R.L. Surf. 64·02'
R.L. Pre-T. Surf. -235'

N.S. 32
R.L. Surf. 63·80'
R.L. Pre-T. Surf. -118'

Bundamba

Old. Ind. N°7
R.L. Surf. 131·36'

Old. Ind. N°8
R.L. Surf. 100·03'

220 N.
210 N.
200 N.
190 N.
180 N.
170 N.
160 N.
150 N.
140 N.
130 N.
120 N.

20 W.
10 W.
0
10 E.
20 E.
30 E.
40 E.
50 E.
60 E.

P.D.T.S. Nos 7 & 8 MINE AREAS, BUNDAMBA.
SKELETON PLAN
SHOWING
PRE-TERTIARY SURFACE CONTOURS
To accompany report by A.K. Denmead M.Sc. Dec. '32

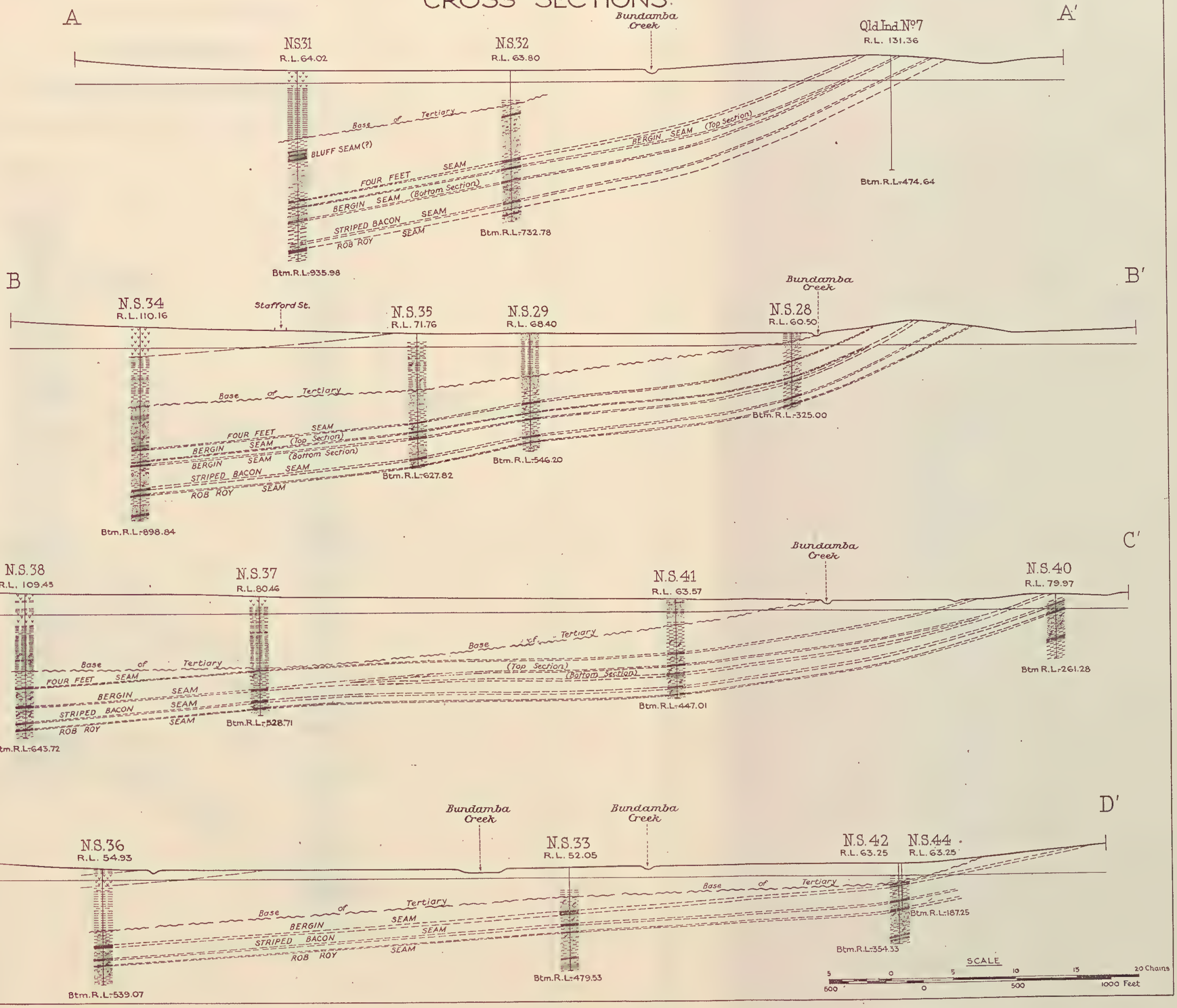
SCALE OF CHAINS

J.A.W. T. & S.S.

Contours plotted by J.O. Cuthbert. B.Sc.

P.D.T.S. Nos.7&8 MINE AREAS
BUNDAMBA
CROSS SECTIONS.

To accompany report by A.K.Denmead M.Sc. 27th Nov.1952.

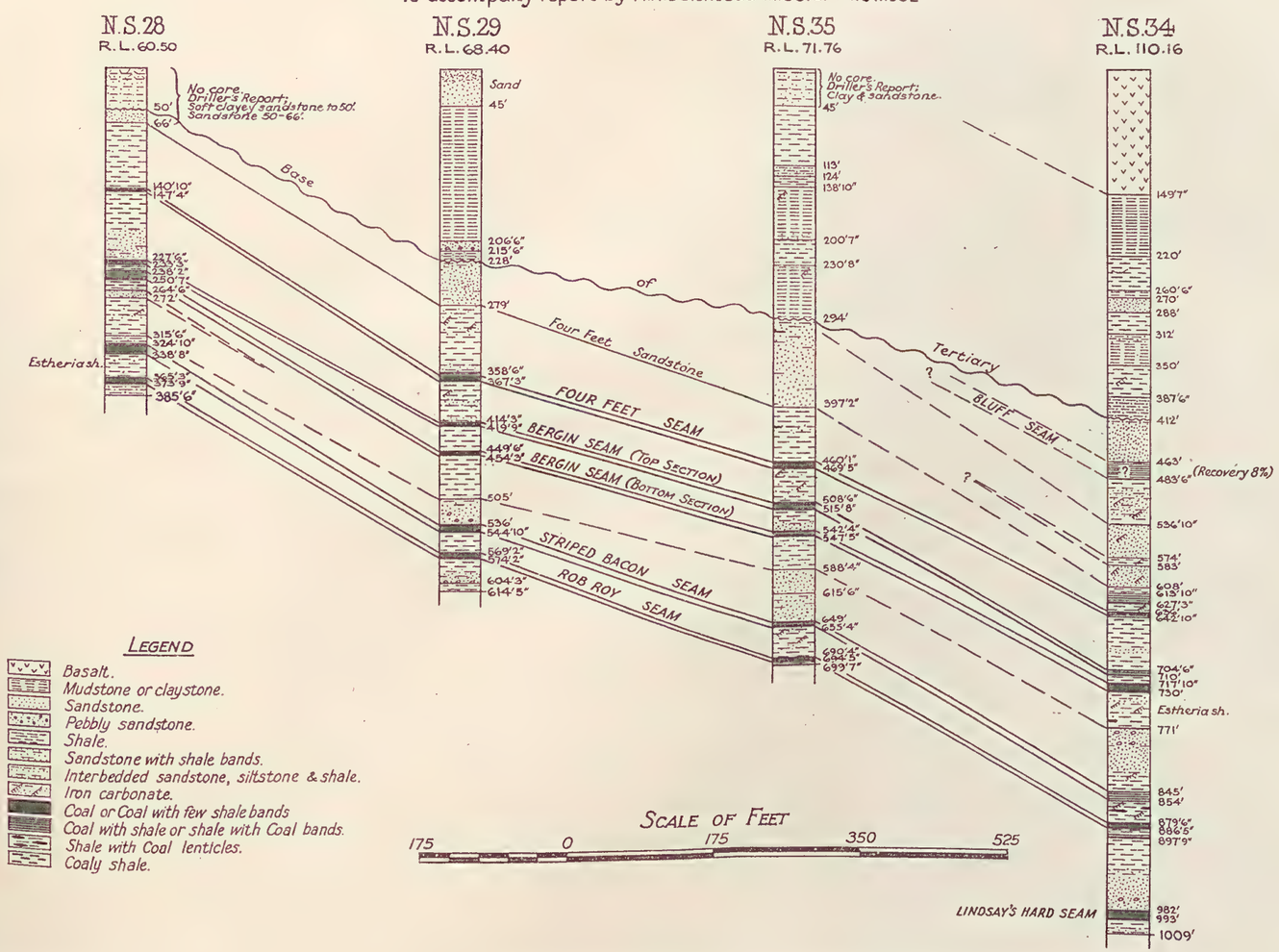


P.D.T.S. Nos 7&8 MINE AREAS

BUNDAMBA

GENERALISED BORE SECTIONS

To accompany report by A.K.Denmead M.Sc. 27th Nov.1952

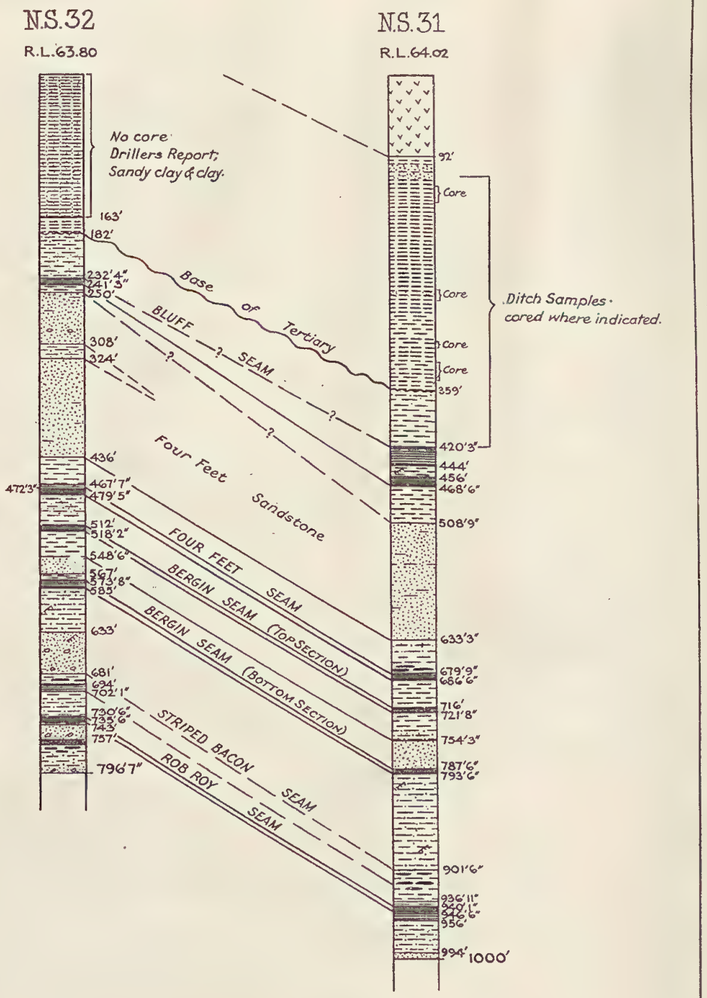


P.D.T.S. Nos 7&8 MINE AREAS

BUNDAMBA

GENERALISED BORE SECTIONS

To accompany report by A.K.Denmead M.Sc. 27th Nov.1952

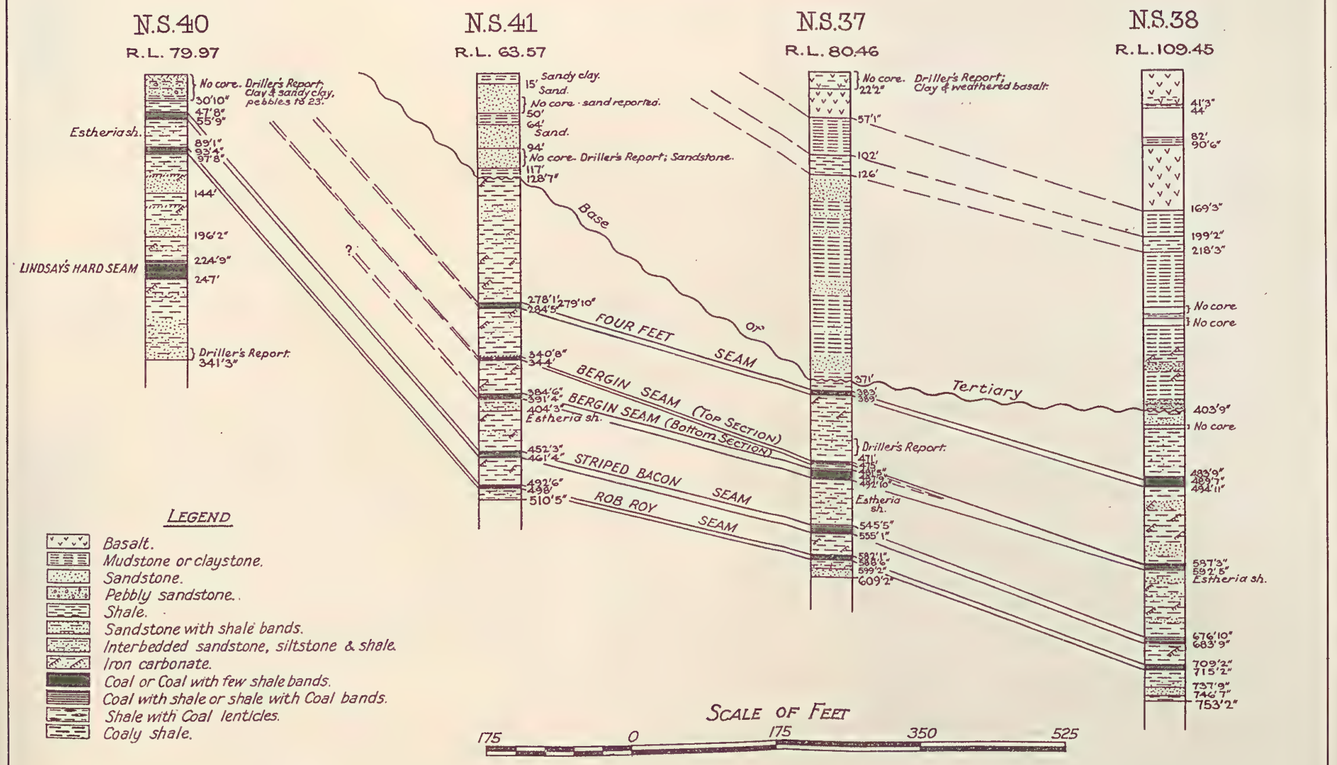


P.D.T.S. Nos 7&8 MINE AREAS

BUNDAMBA

GENERALISED BORE SECTIONS

To accompany report by A.K.Denmead M.Sc. 27th Nov.1952



LEGEND

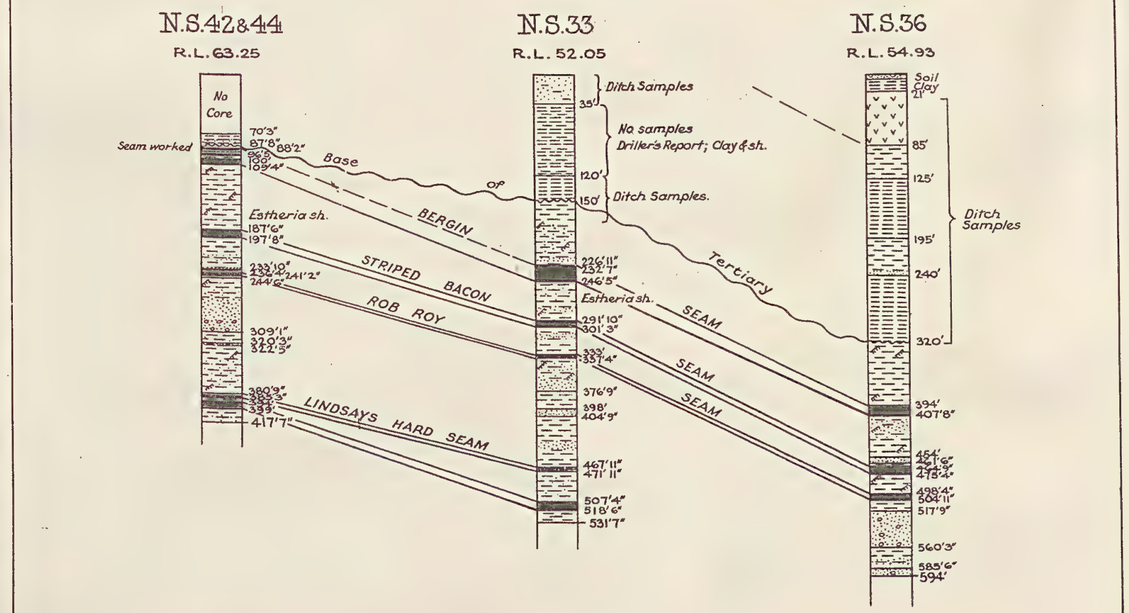
- Basalt.
- Mudstone or claystone.
- Sandstone.
- Pebbly sandstone.
- Shale.
- Sandstone with shale bands.
- Interbedded sandstone, siltstone & shale.
- Iron carbonate.
- Coal or Coal with few shale bands.
- Coal with shale or shale with Coal bands.
- Shale with Coal lenticles.
- Coaly shale.

P.D.T S. Nos 7&8 MINE AREAS

BUNDAMBA

GENERALISED BORE SECTIONS

To accompany report by A.K.Denmead M.Sc. 27th Nov.1952



P.D.T.S. Nos. 7 and 8 MINE AREAS BUNDAMBA DIAGRAMS OF FOUR FEET SEAM, DETAILS OF CORE RECOVERY AND ANALYSES.

N.S. 41

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.3	Cal. 83.5	
V.M.% 30.6	Vol. 75.	
F.C.% 49.2		
A% 17.9		
S% 0.27		
Joules/Gm. 27520		
B.T.U./lb. 11840		
S.G. 1.422		

Overall Recovery By col. 76.3%

Seam Section

	Description
278'1"	1½" inferior coal, ¾" grey sh. 3½" coal with sh. lents & lenses up to ½" thick 1" coaly sh. 1" coal.
279'10"	3½" (partly broken core) coal with top ½" shaly. 1½" fawn sh. ½" dk grey sh. 2" fawn sh. 1½" inferior coal.
280'6"	1½" (broken core) coal. 3" (broken core) coal with ½" band of sh.
282'3"	3" coal - shaly bands ½" thick, 1½" & 2½" from top / 1" shaly patch, 4½" from top. constr. 6½" coal - ½" shaly 4" from top.
284'4½"	1'11" (partly broken core - top 5" solid) coal, some inferior coal few sh. lents.
284'7"	2½" dk grey sh., coal lents.

ROOF; Shale with coal lentricles.
FLOOR; Shale with coal lentricles.

N.S. 37

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
Coal weathered - close to base of Tertiary beds. Not sampled.		

Overall Recovery By col. 72.5%

Seam Section

	Description
383'	1½" buff sh. 2'8" (broken core) coal, some inferior coal.
384'	4" buff sh. ½" inferior coal, ¾" coaly sh. 3" dk. sh. coal with coal sh. lents. 3" dk. grey sh. 1¾" buff sh. ¾" dk. grey sh.
385'9"	1" buff sh. slightly waxy, ¾" coal lens 3¾" interbedded laminae dk. grey & buff sh. 1⅜" coaly sh.
386'2"	1'2½" (partly broken & fragmented core) coal & inferior coal & coaly sh., ¼" sh. lens near middle.
386'5"	½" coaly sh. ½" (broken core) coal. 3" grey sh.
386'11"	¾" boulder nodular iron carb. 1⅜" inferior coal ½" (broken core) inferior coal, 2" shaly coal. 1" dirty fat coal.
387'8"	2½" (broken core) coal. 3⅜" inferior coal & coaly sh.
389'03¾"	⅜" coaly sh. 3" (broken core) coal & inferior coal. 1⅛" dk grey sh. ½" coal.

ROOF; Shale.
FLOOR; Grey shale.

N.S. 38

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.1	Cal. 82.7	
V.M.% 25.9	Vol. 78.	
F.C.% 42.3		
A% 29.7		
S% 0.31		
Joules/Gm. 22860		
B.T.U./lb. 9840		
S.G. 1.519		
Excluded clay ironst. A% 60.3 S.G. 1.870		

Excluding 3" clay ironst at 493'4"

Overall Recovery By col. 79.1%

Seam Section

	Description
483'9"	5" (partly broken core) inferior coal.
486'	2½" dk. grey sh., coal lents at bottom. 4½" light buff sh. ⅝" light grey sh., dk. grey band at bottom.
488'	2" (broken core) / from sh. & inferior coal. 9" light grey sh. 2" dk. grey sh. 5⅝" inferior coal. 2" grey sh. 3" (partly broken core) inferior coal. ⅜" (A. three sh. coal lents) ¾" (broken core) coal 6¾" dk. grey sh. coal lents. 1½" coal ½" dk. sh. lents. 3" coaly sh. 2" inferior coal grading to coal. 1½" buff sh. 1½" dk grey coaly sh. 1⅜" light grey sh.
489'7¼"	2¼" (broken core) inferior coal. 2½" (half core) coal.
490'	2½" (half core) coal. 1" dk grey sh. 5½" (partly broken core) inferior coal, 1" coal at bottom, ¼" dk grey sh. 6¾" coal & inferior coal. 3" (broken & fragmented core) coal. ½" dk. grey sh.
492'	6½" (broken core) coal. 5" (partly broken core) coal. 2½" dk. grey sh. with ½" coal band ¼" from top 5" (broken core) coal & inferior coal.
493'7"	3" dk. grey coaly clay ironstone.
494'11"	8½" (partly broken core) inferior coal & coal, few sh. bands.

FLOOR; Dark grey shale.

N.S. 28

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.1	Cal. 100	
V.M.% 30.1	Vol. 96. (approx)	
F.C.% 48.4		
A% 19.4		
S% 0.24		
Joules/Gm. 26290		
B.T.U./lb. 11310		
S.G. 1.453		

Overall Recovery By col. 100%

Seam Section

	Description
140'10"	6" (broken core) inferior coal, some fragments light grey sandy sh.
142'3¾"	¾" inferior coal, 1¾" coal, ¼" sh. 2¾" inf coal ¾" sh. 1⅞" coal ¼" (partly broken core) two 2" bands buff sh. with ½" coal between.
144'5"	2' 1¼" (broken & fragmented core) coal & inferior coal, some sh. fragments 2½" 'boulder' nodular iron carb.
147'4"	2'8½" coal with few sh. partings, some inferior coal.

FLOOR; Shale

N.S. 29

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.3	Cal. 100	
V.M.% 27.3	Vol. 98. (approx)	
F.C.% 42.6		
A% 27.8		
S% 0.25		
Joules/Gm. 23110		
B.T.U./lb. 9940		
S.G. 1.530		
M% 2.2	Col. 100.	
V.M.% 28.3	Vol. 98.	
F.C.% 46.3		
A% 23.2		
S% 0.24		
Joules/Gm. 24430		
B.T.U./lb. 10510		
S.G. 1.498		

Overall Recovery By col. 100%

Seam Section

	Description
360'7½"	3½" coal, ½" dk. grey sh. ¾" buff sh. 2¼" coal.
361'3"	5" coal.
361'8"	4" coal, (½" (broken core) coal, 1⅞" coal. ½" buff sh. with coal lents 3⅜" coal ½" buff sh. with dk. grey sh. lents ¾" carb. sh.
362'8½"	6" coal. 'boulder' nodular iron carb. 2" inferior coal. 11" coal with few 'bluey' bands, some pyrite. 1" lenticular 'boulder' band nodular iron carb. 9" coal. 4" inferior coal. 8" coal. 2" inferior coal. 4½" coal. 2⅛" inferior coal & sh. 1" (broken core) coal. 1" inferior coal.
367'3½"	

FLOOR; Shale

N.S. 35

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.8	Col. 83.9	
V.M.% 30.0	Vol. 78.	
F.C.% 45.8		
A% 22.4		
S% 0.30		
Joules/Gm. 25360		
B.T.U./lb. 10910		
S.G. 1.476		

Overall Recovery By col. 80.6%

Seam Section

	Description
462'4"	2½" (broken core) coal.
463'5"	2½" coal. ½" sh. 3" coal & inferior coal. 1¼" coal. 1¾" (broken core) coal & a little carb. sh.
464'3"	3½" buff sh. 1⅛" inferior coal with lents of coal.
464'11"	4" (broken core) coal. 4" coal.
465'11"	12" coal. 2" coal. ½" 'boulder' 2½" coal. 5" (partly broken core) coal. ½" sh. 3½" (broken core) coal. ½" sh. 4" coal. 6" (broken core) coal. 3" coal.
469'5"	2" (broken core) coal & sh. lents ½" coal & sh. bands & lents

FLOOR; Shale

N.S. 34

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.8	Col. 72.3	
V.M.% 27.4	Vol. 68.	
F.C.% 39.8		
A% 31.0		
S% 0.34		
Joules/Gm. 22430		
B.T.U./lb. 9650		
S.G. 1.530		
Excluded sh., A% 78.0 S.G. 2.289		

Excluding 5" sh. at 638'10"

Overall Recovery By col. 75.0%

Seam Section

	Description
636'	6" sh. with ½" band of coal & 1½" buff sh.
637'1"	4" (broken core) coal & sh. incl. 1" buff sh. & ½" dk. grey sh. 3½" inferior coal with coal lents 9" (broken core) coal & a little inferior coal & sh. 2½" coal. 5" sh. 1'2" (broken core) coal & a little sh.
641'	3" (broken core) inferior coal. ½" sh. with coal lents 2½" carb. sh. with coal lents ½" brown sh. 10" carb. sh. with coal lents
642'10"	

N.S. 32

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.3		
V.M.% 26.2		
F.C.% 43.3		
A% 28.2	Col. 63.2	
S% 0.24	Vol. 59.	
Joules/Gm. 22820		
B.T.U./lb. 9820		
S.G. 1.520		
M% 2.2		
V.M.% 27.4		
F.C.% 47.4		
A% 23.1	Col. 66.8	
S% 0.28	Vol. 63.	
Joules/Gm. 25000		
B.T.U./lb. 10760		
S.G. 1.471		

Overall Recovery By col. 69.0%

Seam Section

	Description
472'3½"	12" (broken core) coal & inferior coal with sh. lents.
473'10½"	4½" cream sh. in two bands with 1" inferior coal 2¾" from top.
474'3"	1'8½" (broken core) inferior coal & coal, 1" carb. sh. at top & 1" carb. sh. at bottom.
476'10"	6½" (broken core) coal & inferior coal. 1¾" carb. sh. with coal lents 2½" inferior coal & coal, few sh. lents ½" sh.
479'1¾"	7½" coal & inferior coal.
479'5"	3" inferior coal.

ROOF; 1½" shale overlain by 2" coaly shale and 7" shale.
FLOOR; Shale with few ½" coal bands

N.S. 31

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.6	Col. 83.3	
V.M.% 25.3	Vol. 80.	
F.C.% 38.7		
A% 34.4		
S% 0.24		
Joules/Gm. 20620		
B.T.U./lb. 8870		
S.G. 1.587		

Excluding 3" sh. at 684'

Overall Recovery By col. 78.8%

Seam Section

	Description
679'9½"	6" coal, carb. sh. & inferior coal with coal lents
682'6"	7" carb. sh. with coal lents
683'	7" coal with pyrite & sh. lents & lens up to ¼". 2" buff sh. with coal lents ⅜" buff sh. with coal lents 1" coal. 4" coal with ¼" sh. lens. 8" (broken core) coal. 3" sh. 2'1" coal.
686'6"	

FLOOR; Shale with coal lenticles.

P.D.T.S. Nos. 7 and 8 MINE AREAS BUNDAMBA DIAGRAMS OF BERGIN SEAM, DETAILS OF CORE RECOVERY AND ANALYSES.

N.S. 42 & 44

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
N.S. 42 & 44 TOP SECTION OF BERGIN SEAM		
No Recovery (OLD WORKINGS)		
BOTTOM SECTION OF BERGIN SEAM		
N.S. 42 · 89'11" – 97'3"		
N.S. 44 · 88'2" – 97'		

Seam Section — Description

N.S. 33

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.6	Col: 76.6	
V.M.% 27.5	Vol. 70.	
F.C.% 43.3		
A% 27.6		
S.% 0.67		
Joules/Gm. 23720		
B.T.U./lb. 10200		
S.G. 1.516		
BERGIN SEAM OVERALL RECOVERY By col. 82.5%		

Seam Section

226'11" — 2' coal (partly broken core)
229'5" — 1½" light grey sh. 3½" coal. 1d light grey sh. 1" (broken core) coal. ½" sh. 1" grey sh. ¾" coal. ½" grey sh. ½" coal. ½" (broken core) coal. 1" coal. 3" coal. 1" (broken core) coal. 3" coal. 7" (broken core) coal with at least 2 bands grey sh. · one 1½" & one ½" band
232'6" — 1½" dk. grey sh. with coal lents.
232'6½" — ½" coal. 5" black sh. with coal lents. ½" coal lent. ½" penny band grey sh.
7" (broken core) coal with 2 bands grey sh. ½" grey sh. 1" coal. ½" grey sh. 1" & ½" 1½" coaly sh. 1" coal. 2½" black sh.
234'5" — 1¾" coal. 3" inferior coal. 1'4" coaly black sh. with coal lents.
237'5" — 3¾" inferior coal. ⅛ coaly sh. 2" coal. 4" coal. 1½" dk. grey sh. } (broken core) 1½" coaly sh. with coal lents. 4" (broken core) coal & sh. · mainly coal. 1½" grey sh. 3" (broken core) coal with few penny bands 2½" coal. ½" sh. 2" coal 2" (broken core) coal with penny band. 3/16" coal. ¾" sh. 1½" coal. 1½" grey sh. 2" coal (broken core 1") ½" black sh. 1½" grey sh.
240'5" — 6" coal. 1" grey sh. 3" coal. ½" sh. 1½" coal. 1½" (broken core) coal. 2½" grey sh. 2" coal. 1½" grey sh. 1½" (broken core) coal 2" grey sh. 4" coal. 3" (broken core) coal.
243'5" — 3" grey sh. 1½" grey sh. with coal lents. 1½" coal. ½" sh. 1" coal. ½" sh. 2" (broken core) coal. 1½" sh. with coal lents 5½" coal (4" broken core) 1½" grey sh. with coal lents. ¾" coal. ½" sh. 5¾" coal (5" broken core) 2" grey sh. with coal lents. 3" (broken core) coal 2⅜" grey sh. with coal lents. 2½" coal
246'5" — 4" grey sh. with coal lents. (broken core).
246'10" — ROOF; Dark grey shale.

N.S. 36 DEFLECTION

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.7	Col. 85.5	
V.M.% 25.8	Vol. 85.	
F.C.% 38.8		
A% 33.7		
S% 0.22		
Joules/Gm. 21510		
B.T.U./lb. 9250		
S.G. 1.580		
BERGIN SEAM OVERALL RECOVERY By col. 76.1%		

Seam Section

394' — 2" (broken core) coal. 6" grey sh. with coal lents. ½" coal. 2½" grey sh. 1½" (broken core) grey sh. 1½" grey sh. 2" shaly coal. 4" (broken core) coal. 2½" grey sh.
395'4"
396' — 1'6" (broken core) mainly coal with a few sh. bands.
398' — 10" (broken core) · mainly coal, 3 sh. bands, ½" near top, 1" black sh. near middle 1½" black sh. & grey sh. & ½" grey sh. near base. 1'3" (broken core) mainly coal but contains some large bands of grey sh. up to 1" each in thickness. 5¾" ironstone.
400'6"
401' — 1'9" (broken core) mainly coal fragments with few sh. fragments. Contains 4 bands of solid core · 1½" ironst. approx. 3" from top, ¾" black sh. approx. 8" from top, ¾" grey sh. approx. 10" from top & 2" grey & black sh's.
403' — 1'4" grey & black sh. approx. 1' from top. with few coal lents.
405'1" — 9" (broken core) coal with few sh. particles.
406'1" — 6" (broken core) coal & grey sh. approx. ½ coal & ½ sh.
407'8" — No core.

N.S. 41

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.1	Col. 100	
V.M.% 28.4	Vol. 100	
F.C.% 41.1		
A% 28.4		
S% 0.31		
Joules/Gm. 23280		
B.T.U./lb. 10020		
S.G. 1.515		
TOP SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 100%		
BOTTOM SECTION OF BERGIN SEAM 383' – 391'4" NO WORKABLE SECTION		

Seam Section

340'8" — 1'1" (broken core) coal. 1½" buff sh. 11½" (broken core) coal. 2" (part broken) fawn sh., coal lents. 12" (broken core) coal, at least one ¼" buff sh. band. 2" fawn sh. 2" coal.
344'4" — ROOF; Dark grey shale. FLOOR; Dark grey shale with coal bands & lentricles.

N.S. 37

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
TOP SECTION OF BERGIN SEAM 471'7" – 475'0¾" NO WORKABLE SECTION		
M% 1.6	Col. 86.2	
V.M.% 29.1	Vol. 80.	
F.C.% 39.7		
A% 29.6		
S% 0.29		
Joules/Gm. 22790		
B.T.U./lb. 9800		
S.G. 1.528		
BOTTOM SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 83.7%		

Seam Section

471' — Dk. grey sh., 2" inferior coal 3½" from bottom.
471'6" — 1" dk. grey sh. with coal lents. 2" inferior coal. ½" sh.
472'5" — 1'1½" coal, few sh. lents. inferior coal in top 3" & bottom 1". ½" grey sh. 4" coal. ¾" grey sh. 1½" coal. ½" lens grey sh. areni/te. ¾" inferior coal. 1" grey sh. (coal particles).
474'6" — 8½" coal & inferior coal. ½" grey sh.
475'0¾" — 3" (broken core) coal & sh. ¾" coal.
475'5" — 4¼" grey sh. with coal lents.
476' — 4½" (partly broken core) sh's, with many coal lents & partings.
477' — 6" grey sh. with coal lents. 1¾" (part broken) coal. ¾" grey sh. with coal lents.
479' — 1'10⅛" grey sh. with coal bands & lents.
479'6" — ½" sh. 1" coal & inferior coal. ½" coal & inferior coal. ¾" sh. 1¼" bright coal, 2¾" grey sh. ¾" inferior coal. some calcite.
481'5" — 1'1½" grey sh., few coal lents & bands.
482'6" — 1¼" (broken core) coal & inferior coal ⅛" sh. 2⅝" coal. (grey sh. 1⅛" inferior coal. 1½" grey sh. 2¾" coal. ½" sh. 6" (broken core) coal.
485'6" — 3' coal with four 1" sh. bands.
487'9" — 9½" coal & inferior coal (partly broken) 1" sh. 10" coal. 1" sh. 1¾" coal. 7" sh. 1½" inferior coal. 1¾" sh., coal lents in middle. 2" coal. 2" sh. with coal lents. 6" (broken core) coal with 1" sh.
490'6" — 8" (broken core) coal with two ¼" sh. bands. 3½" sh. 2⅛" coal with sh. lents. 3" sh. ½" coal with sh. lents.
492'10" — FLOOR; Shale.

N.S. 38

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.2	Col. 85.5	
V.M.% 26.4	Vol. 80.	
F.C.% 35.6		
A% 35.8		
S% 0.26		
Joules/Gm. 20300		
B.T.U./lb. 8740. S.G. 1.597		
A% 643 S.G. 2.996		
M% 2.3	Col. 75.5	
V.M.% 24.9	Vol. 70.	
F.C.% 35.1		
A% 37.7		
S% 0.26		
Joules/Gm. 19500		
B.T.U./lb. 8390		
S.G. 1.617		
TOP SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 70.4%		

Seam Section

585'7" — 3" dk. grey sh. with coal lents. one fragment inferior coal (=3⅛" Col.)
587'2" — 1½" dk. grey sh.
587'3½" — 12" (part broken) coal with bands inferior coal, dk. grey sh. in last ½".
589'2" — 1" buff sh. 3¾" inferior coal. 1" sh. 7⅛" (part broken) inferior coal & coal.
589'10½" — 2¾" nodular iron carbonate "boulder." ¾ (broken core) coal
590'6½" — ½" nodular iron carbonate "boulder." 1⅝" (broken core) coal. ¾" sh. 4½" (broken core) coal.
591'2" — 1" buff sh. 3½" (broken core) coal 1⅞" grey sh. 4⅛" (broken core) coal.
592'5" — 4" dk. grey sh., coal lents. 1⅝" inferior coal. ½" grey sh. 1" coaly sh., coal lents. 2½" dk. grey sh., coal lents. 1½" dk. grey sh. 2¼" coaly sh. ½" grey sh. ½" dk. grey sh.
593'2" — 6⅛" (broken core) coal.
595'2" — 5" (part broken) coal & sh. bands.
FLOOR; Shale with coal lenticles.

N.S. 28

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.9	Col. 71.6	
V.M.% 27.9	Vol. 67.	
F.C.% 41.5		
A% 28.7		
S% 0.25		
Joules/Gm. 22920		
B.T.U./lb. 9860		
S.G. 1.529		
OVERALL RECOVERY By col. 72.7%		

Seam Section

227'8" — 3½" broken & fragmented core & 1'5" solid core, coal & sh.
228'9" — 3'5½" (broken & fragmented core with some solid pieces) coal & inferior coal, some sh. ½" sh. at top & ¾" sh. near middle · sh. fragments more abundant in last 12".
232'10" — 2" (broken core) coal & sh.
233'3" — 3" sh. & coal lent. bands.
234'1" — 5" Dk. grey sh. few coal lent.
ROOF; 1' dark grey shale overlain by sandstone.

N.S. 29

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 2.1	Col. 78.3	Excluding 4" interbedded coal & sh. at 415'9"
V.M.% 27.2	Vol 75.	
F.C.% 41.9		
A% 28.8		
S% 0.27		
Joules/Gm. 22760		
B.T.U./lb. 9790		
S.G. 1.531		
Excluded Shale A% 61.3 S.G. 1.958		
TOP SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 83.2%		
BOTTOM SECTION OF BERGIN SEAM 449'6½" – 454'3" No Workable Section		

Seam Section

413'5" — 10" carb. sh.
414'3" — 7" inferior coal & coal with ¾" band sh.
414'11" — 7" (broken core) coal. 4" alt. coal & sh bands (abt. ½" bands) 10" (partly broken core) inferior coal & coal. ½" sh.
417'8½" — 4' (broken core) coal & inferior coal. 4" sh dk. grey with coal lents. 6¾" (broken core) coal & inferior coal. 3" shaly inferior coal. 1¾" dk. grey sh. with coal lents. 3" sh. inferior coal. 1½" dk. grey sh. with coal lents. 2" shaly inferior coal.
421'11" — 2'2½" dk. grey sh. with coal lents & thin bands.

N.S. 35

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.8	Col. 77.9	Excluding 1½" Sh. at 509'
V.M.% 24.5	Vol. 75.	
F.C.% 37.4		
A% 36.3		
S% 0.24		
Joules/Gm. 20030		
B.T.U./lb. 8620		
S.G. 1.615		
Excluded Shale A% 79.3 S.G. 2.392		
TOP SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 88.8%		
M% 1.9	Col. 60.5	
V.M.% 24.7	Vol. 55.	
F.C.% 36.9		
A% 36.5		
S. 0.41		
Joules/Gm. 19900		
B.T.U./lb. 8560		
S.G. 1.608		
BOTTOM SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 58.7%		

Seam Section

508'4" — 2" sh. with coal lents. ¾" coal with sh. lents. 3¼" (broken) coal. ½" coal. ½" sh.
509'1" — 1" sh. 7" (broken) coal & a few sh. bands. 1" sh. & coal lents. ½" light grey sh. 2" (broken) coal, inferior coal & sh. 2½" coal & sh. lents. ½" sh. 6" coal with sh. lents. 1½" coal. 4½" sh. & coal bands. 4½" (broken) sh. & coal. 5½" sh. with few coal lents.
511'4" — 7" coal with numerous sh. lents. 4½" sh. with few coal lents. 4½" coal with numerous sh. lents. 2" sh. & coal lents. 3" sh. & coal lents. 1½" (broken) coal & sh. 2½" coal & sh. lents. 1" sh. 1" coal. 1" sh. 1½" sh. & coal lents. 2½" sh. 1" inferior coal & sh lents.
514'4" — 1'8½" sh. with occasional coal lents.
517'4" — 2" (broken) sh. with coal lents. 2" sh. with few coal lents. 1" inferior coal with sh. lents. 5" sh. with few coal lents.
518'4" — 540' — 541'2" — 1'2" dk. grey sh. with few coal lents. 2¼" coal with ½" sh. lents & pyrite. 3½" sh. with coal lents. 5¼" (broken) sh. (up to ¾" bands) & coal (up to 1" bands). 1⅝" inferior coal. 2½ coal. ½" sh. 3" (broken core) coal & sh. 1½" sh. with coal lents. 7¾" coal with occasional sh. lents and pyrite. 5" (broken) inferior coal & sh. 1" inferior coal. 2" (broken) coal.
544' — 547'4½" — 6⅛" sh. with coal lents.
547'11"

N.S. 34

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.5	Col. 73.0	
V.M.% 23.6	Vol. 70.	
F.C.% 31.2		
A% 43.7		
S% 0.18		
Joules/Gm. 17080		
B.T.U./lb. 7350		
S.G. 1.699		
TOP SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 83.3%		
M% 1.7		
V.M.% 27.1		
F.C.% 36.5	Col. 81.2	
A% 34.7	Vol. 75.	
S% 0.28		
Joules/Gm. 20460		
B.T.U./lb. 8800		
S.G. 1.598		
BOTTOM SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 75.5%		

Seam Section

704'6" — 5½" (broken) dk. grey sh. & coal. 1" coal. 3" sh. with coal lents. 3" coal. 2½" sh.
705'11" — 3" (broken) sh. with coal lents & coal. ½" sh. 1" coal. ½" sh. 4" coal. 3½" (broken) coal & a little sh (incl. some 1½" sh. 2" coal. ½" sh. bands of at least ½") 2½" inferior coal with shaly lents. 2" sh. 4½" coal with sh. lents. 1½" (broken) coal. 1" sh. with coal lents. 3½" inferior coal with sh. lents. ¾" sh. 1¾" coal. ½" sh. 7" (broken) coal.
709'7½" — 710' — 2" sh., 1¾" inferior coal with pyrite. ¾" sh.
717'10" — ½" inferior coal with sh. lents. 3" sh. 1" inferior coal with sh. lents. 5½" sh. with coal lents. 5" coal & inferior coal with sh lents. 2" sh.
720'3" — 3" coal with sh. lents.
720'6" — 2" coal, ½" sh., 1⅛" coal.
721' — 1" sh., 2½" coal. 2¼" (broken) coal. 4½" coal. 1" sh., 1¾" coal. 2" (broken) coal. 1½" sh. with coal lents. 5" coal. 3½" (broken) coal & "boulder." 1½" inferior coal, 1" sh. with coal lents. 9" coal. 2" sh. 6" coal. 4" (broken) coal. 3" coal. 2½" (broken) coal. 8" coal. 2" sh.
727'4" — 727'6"

N.S. 32

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled
M% 1.9	Col. 69.9	
V.M.% 27.4	Vol. 60.	Excluding 3⅛" sh. & ½" coal at 514'6½"
F.C.% 42.5		
A% 28.2		
S.% 0.28		
Joules/Gm. 22850		
B.T.U./lb. 9830		
S.G. 1.522		
Excluded Sh. & Coal A% 75 o S.G. 2.253		
TOP SECTION OF BERGIN SEAM OVERALL RECOVERY By col. 86.3%		
BOTTOM SECTION OF BERGIN SEAM 573'8" – 585' Interbedded Coal & Sh. RECOVERY: By col. 94.1%		

Seam Section

512' — 1½" coal. 2⅝" sh. with coal lents. 3½" coal. ¾" sh.
512'4" — 1'1" (broken core) coal with few sh. lents.
514'5" — ½" (broken core) coal. 2" sh. with few coal lents. 1⅝" coal. 1⅝" sh. with coal lents. 2" coal with few sh. lents. 7½" (broken core) coal with few sh. lents.
515'10½" — 1½" coal with sh. lents. 1" sh. with coal lents. 1" coal. 1½" carb. sh. with coal lents. 3" sh. with three bands (2", ½", ½") & coal lents. ½" sh. with coal lents. 1½" coal with few carb sh. lents. 4½" lent bands (90% C) coal & sh. 1" sh. with coal lents.
516'5" — 1¼" (broken core) coal. 6½" coal with lents. bands & lents. of sh. & carb sh.
521'5" — 3'2½" sh. with bands & lents. of coal.
FLOOR; Grey shale with few coal lenticles.

N.S. 31

Proximate Analysis S. Cal Value, S.G.	Recovery per cent	Sections Sampled
No Analysis		
TOP SECTION OF BERGIN SEAM 716' – 721'8" OVERALL RECOVERY By col. 75.%		
BOTTOM SECTION OF BERGIN SEAM 787'6" – 793'5½" Interbeaded Coal & Sh. RECOVERY: By col. 56.2%		

Seam Section

716' — 1" buff sh. 1¼" coal. ¼" sh. 2" (broken) coal. 2⅛" coal with numerous lents. of carb. sh & sh. 2½" sh. with coal lents. 1" coal. 1" mudst. 8½" coal.
718' — 1⅛" sh. ¾" coal. ¼ sh. 1" coal. 2" (broken) coal. 2½" sh. with lents. of coal. 3½" coal with sh. lents. ½" sh. lens. 1¾" coal with sh. lents. ½" dk. grey sh. & brown sh. 1" coal with sh. lents. 2½" sh. with coal lents. 1" coal with sh. lents. 7⅛" sh. with coal lents.
721'8" — 1" coal. 2½" sh. with coal lents. & bands. 1" coal.
FLOOR; Shale with few coal lenticles

P.D.T.S. Nos. 7 and 8 MINE AREAS BUNDAMBA DIAGRAMS OF STRIPED BACON SEAM DETAILS OF CORE RECOVERY AND ANALYSES.

N.S.44

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	2.0	Col. 96.8	
V.M.%	27.4	Vol. 96.	
F.C.%	42.2		
A%	28.4(?)		
S%	0.30		
Joules/Gm.	23240		
B.T.U./lb.	10000		
S.G.	1.532		
A%	55.8(?)	Col. 100.	
S.G.	1.878	Vol. 100.	
M%	2.4	Col. 88.9	
V.M.%	24.6	Vol. 88.	
F.C.%	39.2		
A%	33.8(?)		
S%	0.29		
Joules/Gm.	21510		
B.T.U./lb.	9250		
S.G.	1.570		

Overall Recovery
By col. 93.5%

Seam Section	Description
187'6"	1"(partly broken core) coal.
	1'2½"(partly broken core) coal, boulder in middle.
189'8"	2½" dk. grey sh.
	6" inferior coal & coal.
	⅜" coal.
	11½" coal.
	2" 'bluey'
	½" fawn sh. 1" coal. ¾" sh.
	6"(partly broken core) coal.
191'5¾"	3" dk. grey sh.
	1" sh. & coal.
192'8"	1" coal
	3½" buff sh., ½" dk. grey sh. 1" from top.
	1'2" inferior coal & coal.
	2" buff sh.
	1'2"(broken core) coal, with 1½" 'bluey' at top.
195'8"	
	1'6"(partly broken core) coal & inferior coal.
197'2"	

ROOF; 1'3" dark grey shale.
FLOOR; Dark grey shale.

N.S.33

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	1.8	Col. 65.6	
V.M.%	24.5	Vol. 60.	
F.C.%	37.7		
A%	36.0		
S%	0.29		
Joules/Gm.	20180		
B.T.U./lb.	8690		
S.G.	1.608		
A%	84.8	S.G. 2.337	
M%	1.7	Col. 43.0	
V.M.%	26.7	Vol. 40.	
F.C.%	42.1		
A%	29.5		
S%	0.27		
Joules/Gm.	23300		
B.T.U./lb.	10020		
S.G.	1.530		

Overall Recovery
By col. 62.6%

Seam Section	Description
291'10"	No core - coal reported.
292'2"	3"(broken core) coal.
	2" dk. grey sh.
	7"(broken core) coal.
	4½"(solid core) coal.
	4½"(broken core) coal.
	1" grey sh.
295'5"	3" coal. 2" grey sh.
	4" light grey sh.
	5"(broken core) coal.
297'2"	2"(broken core) coal,
	⅛" light grey sandy sh.
	2⅜" coal.
	5'(broken core) coal.
298'9½"	1" coal.
299'2"	4½" dk. grey sh.
	2" dk. grey sh. 1" coal. 1" dk. grey sh.
299'9"	3"(broken core) 1" coal, 2" dk. grey sh.

N.S.36 Deflection

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	1.7	Col. 86.4	
V.M.%	27.6	Vol. 86.	
F.C.%	47.8		
A%	22.9		
S%	0.30		
Joules/Gm.	25660		
B.T.U./lb.	11040		
S.G.	1.459		
Excluded sh., A%	77.6		
S.G.	2.307		

Excluding 2⅛" sh. at 470'5"
2" sh. at 471'2"

Overall Recovery
By col. 83.1%

Seam Section	Description
464'9"	3⅛"(broken core) coal, at least one thin sh. band.
	⅛" coaly sh.
	1"(broken core) coal.
	6" dk. grey sh., ¼" grey band 3⅛" from top.
	2⅛"(partly broken core) coal & inferior coal.
466'9"	2⅛" carb. sh. grading to dk. grey sh.
	4⅛" dk. grey sh. coal streak & lents in last 2⅛".
	2⅛"(broken core) coal with sh. fragments.
	1'9"(partly broken core) dk. grey sh. with coal bands & lents
469'9"	
	3'(broken & fragmented core) coal with two bands approx. placed as 2⅛" lent" dk. grey sh. band 8" from top. 2" buff sh. band with coal lens 1'5" from top. Few sh. fragments some inferior coal.
472'9"	2"(broken core) coal & coaly sh.
473'5"	5" dk. grey sh. with coal lents
473'10"	1"(broken core) coal, 1" dk. grey sh. 1"(broken core) coal, ⅜" coal, ⅛" dk. grey sh. with coal lents, bands, 2"(broken core) coal, 3⅜" coal with ⅜" buff sh. ½" from top, few 4¾" sh. partings, 4¾"(broken core) coal.
475'4"	2½" inferior coal.

FLOOR; Shale with few coal lenticles.

N.S.40

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	–	Col. 94.5	
V.M.%	–	Vol. 90.	
F.C.%	–		
A%	41.1		
S%	–		
Joules/Gm.	–		
B.T.U./lb.	–		
S.G.	–		

Overall Recovery
By col. 89.4%

Seam Section	Description
47'8"	No core (coal reported).
48'3"	6"(broken core) sh. & coal.
	3"(broken core) coal.
49'3"	2½"(broken core) coal.
	4⅛" crushed sh., ⅛" fault zone dipping 48° in bottom 2⅛".
50'9"	5⅜"(broken core) sh. & coal.
	3" sh.
51'6"	3"(partly broken core) coal, few sh. lents
	7"(partly broken core) coal, few sh. lents
52'1"	¾" buff sh. 1⅛"(broken core) coal, pink ⅛"
	3⅜"(broken core) coal & seam sh. band.
52'6"	1" coal, 1" inferior coal.
52'10"	6⅛"(broken core) coal, one ½" buff sh. band.
	4"(broken core) coal.
	2⅛" sh.
	5⅜"(partly broken core) coal.
	½" sh. lents 3"(broken core) coal & sh.
54'6"	6½" sh. with coal lents & two bands in bottom 3".
	3½"(broken core) coal.
55'6"	¾" coal, 1" sh. (3 iron carbs.) ¾" lens nodular iron carb. (" boulder"). ¾" coal, 1" buff sh.
	7⅛" coal & inferior coal.
56'4"	2⅛" (broken core) coal.
	6½"(partly broken core) sh. with coal lents

ROOF: Shale & fine sandstone.

N.S. 41

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	2.4	Col. 100.	
V.M.%	23.4	Vol. 98.	
F.C.%	36.5		
A%	37.7		
S%	0.32		
Joules/Gm.	19850		
B.T.U./lb.	8540		
S.G.	1.612		

Overall Recovery
By col. 99.1%

Seam Section	Description
452'3½"	½" coaly sh. ¾" coal, 1⅛" 'bluey'.
	2⅜" dk. grey sh., coal lent
	¾" coal
	⅞" sh. ¾" coal, ⅛" thinly bedded coal & sh. (⅛" sh. in top)
	¾" buff sh. 1" dk. grey sh.
	1¾" coal, sh. lents a" from bottom, ⅛" fawn sh.
	2⅜" & coal bands (⅜" coal)
	1" fawn & dk. grey sh. ¾" (broken core) coal.
	⅜" sh. 1" inf. coal
	1⅜" coal, few sh. lents (broken core at bottom).
	¼" sh. lens.
	11"(partly broken core) coal & inferior coal
	⅛" fawn sh. 1⅜" coal & sh. lent bands & lenses.
455'10"	2⅜" sh. 2" inferior coal & coal, thin sh. at bottom.
	8¼" dk. grey sh. band at bottom.
	8⅛" inferior coal & coal.
	3" light grey sh., ¼" coal, ¾" buff sh.
	⅛" dk. grey sh.
	7"(partly broken core) inferior coal & coal.
458'4"	¼" buff sh.
	¼"(broken core) coal, ⅛" fawn sh.
	1" light grey sh.
	8¼"(partly broken core) coal.
	2" dk. grey sh. ⅛" sh. with coal lents
	2⅛"(partly fragmented core) carbolic coal.
	8¼ coal, few sh. lents
	1" fawn sh.
	5" coal, two sh. lenses in top 2"
	4"(broken core) inferior coal, at least one ⅛" sh. band.
461'4"	2½" dk. grey sh., few coaly sh. bands.

ROOF; Dark grey shale

N.S.37

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	1.5	Col. 76.5	
V.M.%	28.3	Vol. 70.	
F.C.%	45.5		
A%	24.7		
S%	0.37		
Joules/Gm.	24980		
B.T.U./lb.	10750		
S.G.	1.477		

Overall Recovery
By col. 93.8%

Seam Section	Description
545'4"	¾" sh. 1" inferior coal.
545'6"	12"(partly broken core) inferior coal, coaly sh. & sh., few bands of bright coal.
	2" sh. with coal lents ⅛" bright coal with sh. lents in middle. ⅛" sh. ⅛" bright coal with sh. lents. ½" sh. with coal lents
	1⅜" sh.
548'	6⅛"(partly broken core) inferior coal, sh. lents ¼" sh. ¾"(broken core) coal & sh.
	¾"(broken core) coal. ⅜" inferior coal.
	3" sh., few coal streaks.
	7"(partly broken core) coal, few sh. lents at top.
	3⅛" coaly at top.
	4" coal.
	1⅛" sh.
	6" coal, few sh. partings.
550'7½"	3⅛" buff sh. 1" coal. 4" sh. lens.
551'	4" coal. ⅛" buff sh. arenite.
	6" coal & some inferior coal.
	⅜" sh. arenite lens.
552'3"	4⅝" coal & inferior coal. ½" buff sh., lent
	5⅜" coal, lent inferior coal.
	¾" buff sh.
	3" (broken core) inferior coal & coal.
	¼" sh.
	11½" coal, few sh. lents
555'1"	¼" sh. ½" coal.
	3" dk. grey sh.
	10"(broken core) sh., coaly sh. & coal.

N.S.38

Recovery in top 3' very low, possibly workable section.

Seam Section	Description
676'8"	2" dk. grey sh.
	2"(broken core) coal.
	4½" inferior coal.
	2"(broken core) coal.
	3½" buff sh.
	1¾" black sh.
	4"(partly broken core) coal.
679'9"	1⅜" coal, 1⅜" buff sh.
	½" coal, ½" rich coal sh.
	3⅛"(broken core) coal.
	¾" fawn sh.
	5" (partly broken core) coal.
	1⅛" coaly sh. & coal. ⅜" coal.
681'9"	8¼" dk. grey sh.
	2⅛" thinly banded coal & sh.
	5⅛" dk. grey sh., many coal lents
	6⅜"(broken core) coal.
	5" sh., coal lents
	5⅜" coal, few sh. lents (partly broken core) coal.
	1⅛"(broken core) coal.
	4" inferior coal.
	⅜" buff sh.
683'9"	3" sandy sh.

N.S. 29 Deflection

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M%	2.2	Col. 91.3	
V.M.%	26.1	Vol. 85.	
F.C.%	41.6		
A%	30.1		
S%	0.35		
Joules/Gm.	22160		
B.T.U./lb.	9540		
S.G.	1.533		
Excluded shale, A%	75.7		
S.G.	2.259		

Excluding 3½" sh. at 540'5½"
2½" sh. at 542'7½"

Overall Recovery
By col. 92.8%

Seam Section	Description
538'2"	4½" inferior coal.
	1" lenticular sh. band with coal lents
539'1"	3" inferior coal with ½" coal at bottom.
	2⅜" sh.
	11"(partly broken core) coal.
540'5"	⅝" inferior coal. 3⅛" sh.
	9"(partly broken core) inferior coal & coal.
	1" lenticular sh. band with coal lents
	5⅝" coal, sh. lent in middle.
	2⅜" sh. with coal lents
	4⅛" inferior coal.
	2⅛" sh.
	11"(partly broken core) coal with few sh. lents
	1⅛" sh. with coal lents
	10¾" coal & inferior coal, few sh. lents
	½" bottom 3"
544'10"	½" thinly interbedded coal & sh.

FLOOR; Shale

N.S. 28, 34 & 35

Proximate Analysis S, Cal. Value, S.G.	Recovery per cent	Sections Sampled

N.S. 28 · Recovery 90% (approx.)

34 " 88% "

35 " 85% "

No Workable Sections.
Not Sampled.

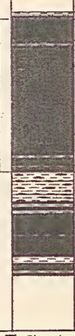
Seam Section	Description

P.D.T.S. Nos. 7 and 8 MINE AREAS BUNDAMBA DIAGRAMS OF ROB ROY SEAM, DETAILS OF CORE RECOVERY AND ANALYSES.

N.S.44

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	2.0	Col. 100.	
V.M.%	27.0	Vol. 100.	
F.C.%	39.9		
A%	31.1		
S%	0.42		
Joules/Gm.	22670		
B.T.U./lb.	9750		
S.G.	1.545		

Overall Recovery By col. 100%



Description

2" dk. grey sh., coal lent³
6" coal, ½" buff sh.
8" (partly broken core) coal.
1' coaly sh., 1" fawn sh.

2'10" inferior coal & coal, few sh. partings, ½" buff sh. 2" from bottom.

7¾" (partly broken core) coal, at least one sh. parting.
1⅛" dk. grey sh.
3' (brok. & en core) coal, thin sh. band at bottom.
⅛" (broken core) fawn sh. 2" coal.

11½" dk. grey sh., coal lents & two ⅛" bands.
¾" coal, 1½" fawn sh.
⅛" coal, 1¼" banded buff sh.
5¾" inferior coal.

2" coal, ¾" fawn sh. ½" 'boulder' nodular iron carb.
3½" coal. 1⅝" 'bluey'.
2⅜" coal, 2½" buff sh.
2⅝" inferior coal.
1⅛" fawn sh. 1" coal.

N.S.33

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.5	Col. 82.1	
V.M.%	29.8	Vol. 80.	
F.C.%	40.7		
A%	28.0		
S.%	0.28		
Joules/Gm.	23550		
B.T.U./lb.	10130		
S.G.	1.532		

Overall Recovery By col. 83.7%

Description

3" (broken core t') coal.
(' light grey sh.
3" 'brushes core) coal.
3" coal, top 1" & bottom ½" shaly.

2'8½" (broken core) coal with ½" coaly sh. 1'3" from top, 1" coaly sh. 1'5" from top & 1" grey sh. 1'9" from top.

3½" dk. grey sh.
1¾" inferior coal.

ROOF; Shale with coal lenticles.

N.S.36 DEFLECTION

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.8	Col. 98.8	
V.M.%	24.4	Vol. 95.	
F.C.%	39.8		
A%	34.0		
S.%	0.26		
Joules/Gm.	21820		
B.T.U./lb.	9390		
S.G.	1.583		
M.%	1.6	Col. 75.7	
V.M.%	30.6	Vol. 70.	
F.C.%	47.4		
A%	20.4		
S.%	0.28		
Joules/Gm.	26460		
B.T.U./lb.	11380		
S.G.	1.439		

Overall Recovery By col. 88.5%

Description

1" thin lent sh. & coal bands.
3½" coal, 1⅛" inferior coal.
2" coaly sh. (part)
⅛" lent sh. band. ¼" inferior coal.
⅝" sh.

6¾" inferior coal & coal, one sh. parting.
3" coal.
7" inferior coal & same coal.
1" sh. with coal lent⁸
4½" coal with lenses of inferior coal.
⅜" dk. buff sh.
6" coal & inferior coal.
4" (broken core) coal.

1'10⅛" (broken core) coal with at least one ¼" buff sh. band.

ROOF; Dark grey shale.
FLOOR; Sandy shale.

N.S.40

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	2.0	Col. 81.4	
V.M.%	26.5	Vol. 75.	
F.C.%	39.9		
A%	31.6		
S%	0.26		
Joules/Gm.	22700		
B.T.U./lb.	9580		
S.G.	1.543		

Overall Recovery By col. 86.2%

Description

3" (broken core) coaly sh. & inferior coal.
¾" buff sh.
2¾" coaly sh., coal lent⁸
5" (broken core) sh. & coal.

1" (partly broken core) sh.
5" (partly broken core) coal.
1" inferior coal. ¾" sh.

1'10⅛" (partly broken core) coal with at least one 1" buff sh. (near bottom) and two ⅛" sh. bands, few sh. lent⁸

4" No core (reported drilled like sh.)
6" dk. grey sh., coal lents, ¼" grey sh. at bottom.
5" (broken core) coal.
1" buff sh.
5" (broken core) coal & inferior coal.
1½" (nodular arch. 'boulder' 1½" (partly broken core) buff sh.
5" (broken core) coal.
4½" (broken core) coal & sh.
1⅝" buff sh.
1'4½" dk. grey sh. 1" grey sh. arenite, 1½" grey sh., coal lents, ¾" coal (half core) 1½" dk. grey sh. 1⅛" coaly sh. ¾" sh.
2" coal, ¼" grey sh. (crushed at bottom)
6⅛" (broken core) sh., few coal fragments.

N.S.41

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	2.0	Col. 90.9	
V.M.%	31.1	Vol. 88.	
F.C.%	45.2		
A%	21.7		
S%	0.41		
Joules/Gm.	25740		
B.T.U./lb.	11070		
S.G.	1.460		
Excluded clay ironst., A%	70.3		
S.G.	2.036		

Overall Recovery By col. 92.4%

Description

4½" inferior coal 'bluey'.
1" fawn sh.
5⅝" (broken core at top) coal, thin sh. band 3" from top.
1'1" fawn sh.
1'2" coal.
⅛" sh. (lenticular). ½" coal. ¼" sh. lens.
9½" (broken core at bottom) coal, thin sh. band 4½" from top.
7½" (partly broken core) coal.
4½" clay iron stone.
7" (broken core at top) coal, inferior in 1⅛" fawn sh. bottom 3"
3¾" inferior coal.

N.S.37

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.6	Col. 82.8	
V.M.%	29.0	Vol. 80.	
F.C.%	44.5		
A%	24.9		
S%	0.25		
Joules/Gm.	24730		
B.T.U./lb.	10640		
S.G.	1.486		

Overall Recovery By col. 84.3%

Description

2" inferior coal. ¾" sh. ¼" coal.
10½" (partly broken core) coal, few sh. lent⁸

2'9" (partly broken core) coal, few sh. lent⁸ ⅛" sh. bands 6" from top & 12" from top.

⅛" dk. grey sh.
1'3¾" coal.

1⅛" coal with iron carb.
6" nodular iron carb. 'boulder'.

N.S.38

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.8	Col. 96.6	
V.M.%	30.4	Vol. 96.	
F.C.%	46.6		
A%	21.2		
S%	0.33		
Joules/Gm.	26530		
B.T.U./lb.	11412		
S.G.	1.447		
Excluded coal & sh., A%	35.0		
S.G.	1.600		

Overall Recovery By col. 98.6%

Description

3" (broken core) coal.
1" fawn sh. ¼" sh. & coal. 1⅛" (broken core) coal.
¾" (broken core) coal.
11" coarse coal, few sh. partings.

¾" fawn sh.
3⅜" coal & inferior coal. ¾" fawn sh.
4" (broken core) coal.

1'7½" (partly broken core) coarse & bright coal, ⅛" sh. 7" from top.

3½" sh. 2¾" inferior coal.
⅛" (broken core) coal.

11½" (broken core) coal.
2" 'boulder' (nodular iron carb)
2" coal. 1½" 'boulder' (nodular iron carb)
2" coal.

N.S.28

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.9	Col. 91.5	
V.M.%	30.1	Vol. 91.5	
F.C.%	47.7		
A%	20.3		
S%	0.30		
Joules/Gm.	26320		
B.T.U./lb.	11320		
S.G.	1.439		

Overall Recovery By col. 72.2%

Description

No core.

3'7" (broken & fragmented core, powdered in places near top) coal.

1" sh.
1½" (broken core) sh. & coal.
No core.
1⅝" grey sh.
8" (broken core) dk. grey sh. and coal, some grey sh.
5¼" coal.
1⅞" (broken core) coal & sh.
1⅛" dk. grey sh. 2" (broken core) coal, some sh.
4" coal & sh. bands.
1'5½" (broken core) coal.
5½" coal, sh. partings & few bands.
7½" (broken core) sh. & coaly sh. some coal fragments.

11¾" grey sh.

ROOF; Shale

N.S.29 DEFLECTION

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.8	Col. 100	
V.M.%	31.1	Vol. 100	
F.C.%	42.1		
A%	25.0		
S%	0.31		
Joules/Gm.	24100		
B.T.U./lb.	10370		
S.G.	1.501		

Overall Recovery By col. 100.%

Description

2½" inferior coal.
5" coal.
1⅛" sh.
1'7" coal, 'bluey' in top 3" and sh. lent⁸ 9" from top.

2" coal, 1" sh. with coal lent⁸

1'1⅛" coal, ⅜" sh. 9" from top.

4½" coal with nodular iron carb.

ROOF; Dark grey shale.
FLOOR; Shale.

N.S.35

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.4	Col. 93.1	
V.M.%	33.3	Vol. 90.	
F.C.%	37.1		
A%	28.2		
S%	0.29		
Joules/Gm.	22640		
B.T.U./lb.	9740		
S.G.	1.568		

Overall Recovery By col. 93.1%

Description

9" coal (6" broken core)

2'3" (broken core) coal with approx. 4" of sh. bands near top.

1½" sh. with iron carb.
3" (broken core) mainly dk. grey sh., small amount of coaly sh.

ROOF; Dark grey shale.

N.S.34 DEFLECTION

Proximate Analysis S., Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.5	Col. 53.7	
V.M.%	30.0	Vol. 48.	
F.C.%	48.2		
A%	20.3		
S.%	0.28		
Joules/Gm.	26520		
B.T.U./lb.	11410		
S.G.	1.449		

Overall Recovery By col. 57.9%

Description

1" (fragment representing t') inferior coal.
⅜" black sh. ⅛" coal lents. 1" grey sh.
⅝" coal. 1" (broken core) coal. ⅞" coal.
¾" grey sh. 1" coal. ⅝" brown carb. sh.
1" black coaly sh. 4" coal (inferior in middle)

7" (broken core) coal with 3" sh. in four bands, mainly towards top.

⅞" coal, two thin bands sh. at bottom.
⅜" thinly interbedded light grey & coaly sh. grey sh.
7½" coal.
2½" coal.

7½" coal incl. 2" inferior coal 1" from bottom.

½" sh.

8" (partly broken core) coal, thin sh. band.

FLOOR; Grey shale.

N.S.32

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.9	Col. 100	
V.M.%	30.4	Vol. 100	
F.C.%	46.6		
A%	21.1		
S%	0.31		
Joules/Gm.	25760		
B.T.U./lb.	11080		
S.G.	1.442		

Overall Recovery By col. 100%

Description

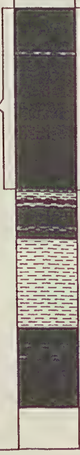
5' coal with 1" sh. band at top & 2" coaly sh. at bottom.

ROOF; Dark grey shale with few coal lenticles.
FLOOR; Dark grey shale.

N.S.31 DEFLECTION

Proximate Analysis S, Cal. Value, S.G.		Recovery per cent	Sections Sampled
M.%	1.8	Col. 100	
V.M.%	31.2	Vol. 98	
F.C.%	29.4		
A%	21.4		
S%	0.24		
Joules/Gm.	25600		
B.T.U./lb.	11020		
S.G.	1.454		

Overall Recovery By col. 100%



Description

5'8" coal · 1" sh. with coal lent⁸ 1'5" from top. 1" sh.

3" dk. grey sh., with coal lent⁸
1" inferior coal, 1⅛" sh. with coal streaks.
7½" coal with calcite lining & few irregular bands of siderite nodular iron carb.
1½" sh. with 6" coal with calcite facing band
3" coal with calcite facing and nodular iron carb. sh. lens near top. (in middle.

2'9" sh.

2'6½" coal with sh. bands & lenses 1⅛" boulder band near bottom.

ROOF; Hard carbonaceous shale.

P.D.T.S. Nos 7&8 MINE AREAS

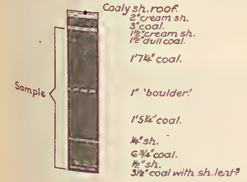
BUNDAMBA

SECTIONS OF FOUR FEET SEAM IN MINE WORKINGS

S1

ABERDARE No8 COLLIERY

NORTH OF BRAESIDE FAULT



Total thickness sampled

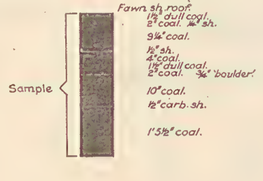
4' 2"

M%	2.4
V.M.%	29.2
F.C.%	46.4
A%	22.0
S%	0.28
Joules/Gm.	25250
B.T.U./lb.	10860
S.G.	1.474

S2

ABERDARE No6 COLLIERY

ON N.W. SIDE OF WASHOUT



Total thickness sampled

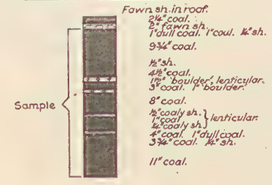
4' 2"

M%	2.5
V.M.%	29.1
F.C.%	47.6
A%	20.8
S%	0.36
Joules/Gm.	26300
B.T.U./lb.	11310
S.G.	1.450

S3

ABERDARE No6 COLLIERY.

BOTTOM OF DIP NEAR 12'6" UPTHROW FAULT



Total thickness sampled

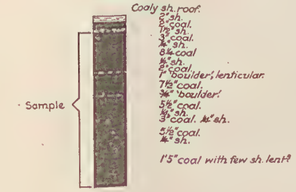
4' 4¼"

M%	1.8
V.M.%	29.9
F.C.%	45.9
A%	22.4
S%	0.26
Joules/Gm.	25350
B.T.U./lb.	10900
S.G.	1.479

S4

ABERDARE No6 COLLIERY

N.E. SIDE OF PILLAR PENETRATED BY N.S.41



Total thickness sampled

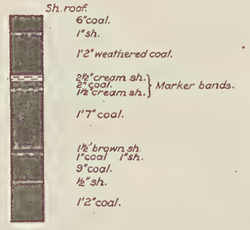
4' 6¾"

M%	2.2
V.M.%	28.6
F.C.%	47.8
A%	21.4
S%	0.25
Joules/Gm.	25560
B.T.U./lb.	11000
S.G.	1.470

S5

POR. 163 · PARISH OF GOODNA

ABANDONED TUNNEL



Section only

To accompany report by A.K. Denmead M.Sc. 27th Nov. 1952.

P.D.T.S. Nos 7&8 MINE AREAS

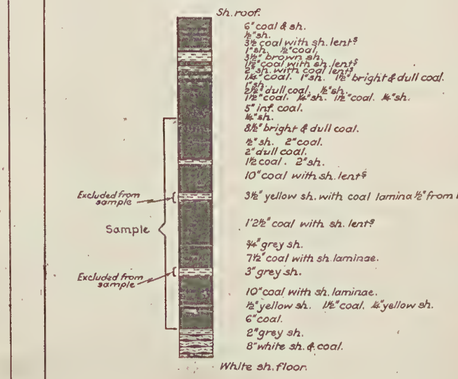
BUNDAMBA

SECTIONS OF STRIPED BACON SEAM IN MINE WORKINGS

S13

ABERDARE No6 COLLIERY

IN STAPLE SHAFT


Sh. roof.
6" coal & sh.
½" sh.
3½ coal with sh. lents
1" sh.
½" coal.
3½" brown sh.
1⅛" coal with sh. lents
6" sh. with coal lents
1½" coal. 1" sh. 1½" bright & dull coal.
5⅛" dull coal. ½" sh.
1⅞" coal. ½" sh. 1½" coal. ½" sh.
5" inf. coal.
½" sh.
2½" bright & dull coal.
½" sh. 2" coal.
2" dull coal.
1½ coal. 2" sh.
10" coal with sh. lents
Excluded from sample
3½" yellow sh. with coal lamina ½" from bottom.
Sample
1'2½" coal with sh. lents
¾" grey sh.
7½" coal with sh. laminae.
3" grey sh.
Excluded from sample
10" coal with sh. laminae.
½" yellow sh. 1⅛" coal. ½" yellow sh.
6" coal.
2" grey sh.
8" white sh. & coal.
White sh. floor.

Total thickness sampled

6' 2"

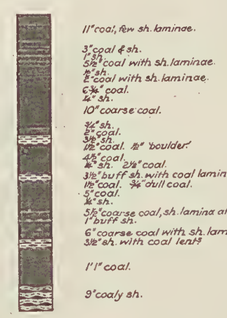
(excluding sh. bands as shown)

M%	2.1
V.M.%	24.7
F.C.%	38.1
A%	35.1
S%	0.27
Joules/Gm.	20460
B.T.U./lb.	8810
S.G.	1.589

S14

CORONATION COLLIERY

TUNNEL No2



Section only.

To accompany report by A.K. Denmead M.Sc. 27th Nov. 1952.

P.D.T.S. Nos 7&8 MINE AREAS

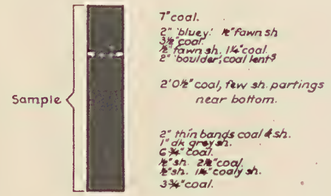
BUNDAMBA

SECTIONS OF BERGIN SEAM IN MINE WORKINGS

S6

ABERDARE No8 COLLIERY

SAMPLE NEAR BRAESIDE FAULT



Total thickness sampled

4' 11½"

M%	2.4
V.M.%	28.8
F.C.%	45.2
A%	23.6
S%	0.31
Joules/Gm.	24490
B.T.U./lb.	10440
S.G.	1.487

S7

ABERDARE No8 COLLIERY

BOTTOM OF MAIN DIP

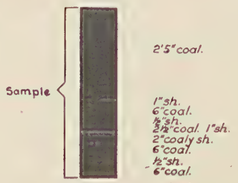
Section incomplete.

Section only

S8

ABERDARE No8 COLLIERY

SAMPLE 1 CHAIN FROM BOTTOM OF MAIN DIP



Total thickness sampled

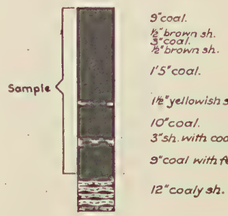
4' 6½"

M%	2.2
V.M.%	28.8
F.C.%	47.8
A%	21.2
S%	0.27
Joules/Gm.	26190
B.T.U./lb.	11270
S.G.	1.457

S9

ABERDARE No8 COLLIERY

SE. SIDE OF PILLAR PENETRATED BY N.S. 41



Total thickness sampled

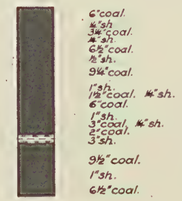
4' 5½"

M%	2.4
V.M.%	26.8
F.C.%	46.4
A%	24.4
S%	0.28
Joules/Gm.	24620
B.T.U./lb.	10600
S.G.	1.503

S10

POR. 162 PARISH OF GOODNA

OLD TUNNEL



Section only.

S11

POR. 162 PARISH OF GOODNA

OLD TUNNEL

Sh. roof.
Excluded from sample
Sample
12" coal.
¼" sh.
10½" coal, last 1" stony coal.
¾" brown sh. 1" coal.
4" grey sh. 1½" coal.
1½" brown sh. with few coal lent$
11" coal with two sh. laminae in last 3".
1" sh.
10½" coal.
¼" sh. ¾" coal. ¼" sh.
1¼" coal. ¼" sh.
2¾" coal. ½" sh.
4½" coal with two sh. laminae.
2" carb. sh.
1'5" coal with at least six ¼" sh. laminae.

Total thickness sampled

6' 11½"

M%	2.9
V.M.%	25.7
F.C.%	40.4
A%	31.0
S%	0.25
Joules/Gm.	21460
B.T.U./lb.	9230
S.G.	1.558

Excluded sh.,

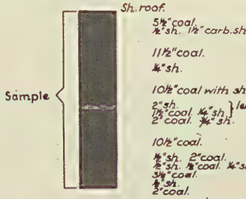
A% 79.7

S.G. 2.388

S12

ABANDONED TUNNEL

APPROX. 17.5 CHAINS WEST OF SE. CORNER OF POR. 163 PARISH OF GOODNA



NOTE: Sample taken on N side of tunnel (14' N & 17½' W from peg N2). Sixty-six feet east of this section the seam is underlain by 11" sh. & at least 8'6" of interbedded coal & sh.

Total thickness sampled

4' 8½"

M%	3.4
V.M.%	25.9
F.C.%	42.7
A%	28.0
S%	0.29
Joules/Gm.	21700
B.T.U./lb.	9340
S.G.	1.556

To accompany report by A.K. Denmead M.Sc. 27th Nov. 1952.

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(C. C. Morton, M.C., A.C.T.S.M., Chief Government Geologist)

PUBLICATION No. 281

COAL RESOURCES, TOOLOOMBAH CREEK AREA, STYX COALFIELD

Compiled at the Geological Survey
With 2 Appendices

BRISBANE

By Authority: A. H. Tucker, Government Printer

1955

PREFACE.

This report sets out the results obtained from a departmental drilling campaign carried out in the search for a new mine area in the Tooloombah Creek area, Styx Coalfield, between February, 1948, and December, 1951. It was prepared at the Geological Survey, Brisbane, and represents the combined work of a number of officers both in the field and in its preparation.

In all, sixteen holes (including one repeat) numbered N.S. 8 to N.S. 23 were drilled with an aggregate of 12,346 feet. Omitting one scout hole (N.S. 23) the area tested was some 300 acres in which reserves were proved in three seams.

With no less than 8 coal horizons represented in some 430 ft. of strata comprising the main productive group and in view of the markedly lenticular nature of both coal seams and enclosing strata, seam correlation presented difficulties. However, by combining microspore analysis with stratigraphical evidence it is felt that the estimates of reserves presented are based on firm correlations.

As set out in Tables II. and III. the boring has resulted in proving an aggregate of some 4 million tons of *total* measured reserves with a coal thickness of 3 ft. minimum contained in seams C, E and F within the areas defined in figures 4, 5 and 6 respectively. Included in that total are almost 2 million tons in seams C and E, representing sections with 4 ft. or over of coal. However, for various reasons, chief of which concerns availability of coal beneath the deep and wide channel of Tooloombah Creek, only some 75 per cent. of the aggregate reserves are counted on as available. In this connection C seam, being under relatively shallow cover, is most affected.

The coal included in reserves is high-volatile bituminous with under 0·5 per cent. sulphur and average ash contents of 8·7, 11·0 and 10·1 per cent. in seams C, E and F respectively.

Accompanying the report are the following appendices and plans:—

(1) Report by Dr. N. J. de Jersey on Microspore Correlation as applied to the Tooloombah Creek Area (with one plate).

(2) Report by C.S.I.R.O. on the identity of a green mineral found in certain sandstones in some of the bores.

(3) Locality map (Fig. 1).

(4) General plan of the area showing bore sites, &c. (Fig. 2).

(5) Plan showing coal sections sampled (Fig. 3).

(6) Plans showing reserve areas on C, E and F seams (Figs. 4–6).

(7) Cross Sections (W–E) (Fig. 7).

(8) Detailed seam sections (Figs. 8–10).

(9) Bore Logs N.S. 8 to N.S. 23 (Fig. 11).

C. C. MORTON,

Chief Government Geologist.

FIG. 1

LOCALITY PLAN

TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD

SCALE OF CHAINS

40 0 40 80

REFERENCE

Bore sites.....⊙

Working colliery.....

Abandoned colliery.....

Styx State Mine

Ogmore P.O.

Ogmore Rly Stn.
85 m. from Rhampton.

Ogmore School

Styx R.

North Coast Railway

43M

44M

19M

20M

True N.

Magnetic N.

Bowman Rly. Stn.
82 m. from Rockhampton.

Bowman State Mines Nos 1 & 2

Old No 21 ⊙

⊙ Old No 20

Bowman Mine

Old No 6 ⊙

⊙ Old No 22

To Rockhampton

Ck.

Tooloombah

□ Stewart's Shaft
(Coal reported)

AREA TESTED

Deep Ck

COAL RESOURCES, TOOLOOMBAH CREEK AREA, STYX COALFIELD.

Introduction.

In consequence of the approaching exhaustion of the working seam in No. 3 State Mine at Ogmore, on the Styx Coalfield, it became necessary in 1947 to search for a suitable seam to take its place. The first proposal was to bore downwards from the existing workings to test a seam which was known to underlie the working seam.

In January, 1948, the District Geologist, S. R. L. Shepherd, visited Ogmore for the purpose of selecting suitable underground drilling sites. While on the field he examined some coal outcrops in Tooloombah Creek, some four miles south of Ogmore to which his attention had been drawn by J. D. East, Geologist. He was favourably impressed by the prospects of the area and recommended drilling there instead of at Ogmore.

This recommendation was accepted by the Minister and the Mines Department, using a Sullivan N. No. 1 rig, commenced drilling in February, 1948. The first hole which was designated N.S.* No. 8 yielded such encouraging results that a systematic drilling campaign was decided upon. The campaign, which occupied a period of three years and ten months, involved the drilling of sixteen holes (including one re-drill) and embraced an area of 300 acres.† Aggregate footage drilled was 12,346, individual depths ranging from 380 ft. to 1,200 ft. The holes were numbered N.S.8 to N.S.23.

Total measured reserves of coal with minimum seam thickness of 3 ft. are 4,028,000 tons in three seams. Total measured reserves with a minimum seam thickness of 4 ft. are 1,941,000 tons in two seams. In no case have the workable limits of the seams been completely defined and it is believed that considerable additional reserves may exist to the south and south-east. Availability of the above reserves is likely to be restricted to a small extent by faulting and to a substantial degree by the relatively thin cover over C seam beneath the wide channel of Tooloombah Creek. These seams are in the main unbanded and inherent ash is moderately low (usually not more than 10 per cent.). The coal which is of high-volatile bituminous rank is weakly coking but is well suited to steam raising and gas making.

The report is accompanied by the following annexures:—

(1) An appendix by N. J. de Jersey, Ph.D., on Microspore Correlation as applied to the Tooloombah Creek Area (with one plate).

(2) An appendix by Dr. F. L. Stillwell on "Hydromica in Sandstone from Styx Coalfield, Queensland."

(3) A Locality Map (Fig. 1).

(4) A plan of the Tooloombah Creek Area showing 20-chain grid, bore sites showing seam depths, geological features and sub-surface contours on C Seam (Fig. 2).

(5) Plan showing coal sections sampled (Fig. 3).

(6) Three plans showing isopachs on C, E and F Seams (Figs. 4–6).

(7) Cross Sections (W–E) (Fig. 7).

(8) Detailed Seam Sections (C, E and F Seams) (Figs. 8–10).

(9) Graphical Bore Logs N.S.8 to N.S.23 (Fig. 11).

Situation (*See Fig.* 1).

The bored area (hereinafter referred to as the "Tooloombah Creek Area") is situated between two and three miles south-south-westerly from Bowman railway station and four miles south of Ogmore which is 85 miles from Rockhampton.

Topographically the country is comparatively level and of the "melon hole" type. It is thickly vegetated with brigalow scrub which in this district is generally a distinctive feature of the coal measures. The Styx River and its tributaries, Tooloombah Creek and Deep Creek, have dissected the surface to a depth of approximately 50 ft. Rock exposures are restricted to these watercourses.

The construction of a branch railway to the bored area would necessitate the building of a bridge over either Deep Creek to Bowman or the Styx River (and perhaps also Tooloombah Creek) to Ogmore.

History of the Field.

The discovery of coal in 1887 was followed by some prospecting for two or three years, but it was not until 1918 that a shaft was sunk by the Queensland Government at Bowman to exploit a promising seam previously located by diamond drilling. Production commenced at this mine, known as Styx State No. 1 Colliery, in the following year. Owing to the unsuitability of the first site a second shaft (No. 2 Mine) was sunk 10 chains to the south. The mines at Bowman were abandoned in 1925 in favour of No. 3 mine at Ogmore 2½ miles to the north. This colliery operated continuously on one seam for 25 years. As mentioned earlier the approaching exhaustion of this seam forced the Government to consider a number of alternative proposals for a new site and led to the drilling campaign which forms the subject of this report. Private enterprise entered the field in 1930 when the Bowman Syndicate opened up a colliery adjacent to the old State Mine at Bowman. This pit produced 65,000 tons of coal between 1932 and 1948, the year of its closure. Total production of No. 3 mine exceeds one million tons.

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* N.S.=New Series.

† Not including one scout-hole, N.S.23.

Procedure.

On completion of the first bore N.S. No. 8 which was selected arbitrarily, a grid with co-ordinates at 20 chain intervals was laid out based on N.S.8 and subsequent bores were located as nearly as practicable at the grid intersections. All sites were located in the first place by chain and compass traverses. The bores (with the exception of N.S.23) were subsequently surveyed by D. S. Ryland, Authorised Surveyor or by L. W. Meyers, Staff Surveyor, who also did all the requisite levelling. The area drilled embraced an area of approximately 300 acres. (See Fig. 2.)

Examination and logging of the bore cores (with the exception of N.S.21 which was done by T. D. Dimmick (Geologist) were carried out by either S. R. L. Shepherd, District Geologist, or J. D. East, Geologist. All possibly workable coal sections were forwarded by the driller in charge to the Geological Survey, Brisbane, for detailed logging and examination by the coal petrologist. Subsequently, such sections as were considered of present or future economic interest were submitted to the Government Analyst for proximate analysis and other tests. Additionally Dr. N. J. de Jersey examined all coal beds in two holes for their spore content.

Geology.

The coal measures of the Styx Coalfield occupy an area of approximately 120 square miles. They are confined to a narrow belt 5 miles wide and some 25 miles in length, the elongation being in a north-south direction. The Styx Coal Measures are wholly terrestrial in origin and have yielded a fossil flora which includes some dicotyledons and which Walkom (1920) regarded as indicating a Lower Cretaceous age.

W. H. Rands (1892) who first investigated the field showed that the coal measures were faulted on the east against Palaeozoic basement rocks. The measures are severely folded and faulted for some distance from this boundary. On the west side of the field similar basement rocks are found lying unconformably under the coal measures. The basement rocks are slightly folded, indurated sandstones, shales, conglomerates and quartzites stated by J. H. Reid (1924) to be of Permo-Carboniferous age. The boring has shown that the surface on which the coal measures were deposited was one of considerable relief. The coal measures are deeply weathered. In the boreholes unweathered material was seldom found at a shallower depth than 70 ft. Such rock exposures as do exist are confined to the major watercourses.

The Styx Coal Measures have a maximum known thickness of 1,270 ft. in the Tooloombah Creek Area. They comprise sandstone (mostly fine-grained) and shale both of which may occur in thick individual beds but which more often are finely laminated. The sediments are essentially non-calcareous, though a few thin bands of calcareous sandstone were logged. A basal conglomerate as much as 20 ft. thick was penetrated in two of the four bores that were carried to bedrock and in another hole that was stopped short of basement.

The sediments of the coal measures, including the seams, are markedly lenticular and this feature created uncertainties in the early stages as regards seam correlation. A distinctive green sandstone occurs at a number of horizons. The green colour was found to be due to the presence of a green mineral occurring interstitially between grains of quartz, chert and shale. Examination in the Geological Survey laboratory failed to reveal the exact nature of this mineral and samples were submitted to Dr. F. L. Stillwell of the C.S.I.R.O. Laboratories in Melbourne. Dr. J. McAndrew, to whom the sample was referred, with the aid of X-ray powder patterns and other tests identified it as a *mixed-layer hydromica* with *illite* as the principal constituent. This is the first occurrence of this mineral in Australia known to the C.S.I.R.O. Dr. Stillwell's full report appears as Appendix 2. As drilling proceeded it became apparent that the green beds were no exception to the general lenticularity and the earlier hope that they might serve as "markers" was not realised. Fortunately, however, there is now available a new aid in coal seam correlation.

For the first time in an investigation of this nature in Queensland use was made of a comparatively new geological tool—microspore study. Dr. N. J. de Jersey of the Geological Survey staff has made a careful investigation of the distribution of spore types and he has been able to establish that certain seams have characteristic spore assemblages (Appendix I.). This method, used in conjunction with stratigraphic evidence, has enabled a correlation of the principal seams penetrated in the different bores to be made in most cases with considerable confidence. There has been complete agreement between the field geologist and the coal petrologist in all but three cases.

By contrast with the Bowman area where the coal measures are severely folded and faulted the Tooloombah Creek Area is relatively undisturbed. Dips usually range from horizontal to 10 degrees, the average being 5 to 6 degrees in an easterly direction.

Evidence of faulting was revealed in the cores from N.S.16 and N.S.19 and perhaps also N.S.20. In N.S.19 the fracturing was severe enough to cause the abandonment of the hole. Figure 2 shows an interruption in the 100 ft. contour on C Seam due to the fault encountered in N.S.16*. The spacing of the holes is too wide to enable the trends of the faults to be plotted and for this reason no fault has been shown on the plan. Should this fault trend parallel with the dominant fault direction on this field (north-south) its effect on available reserves would be serious as it would coincide with the direction of the bed of Tooloombah Creek and render mining operations, particularly in C Seam which has only a thin cover here, particularly hazardous. Should the mining of C Seam beneath Tooloombah Creek ever be contemplated preliminary close boring to determine the trend of the fault would be an indispensible pre-requisite.

* It is estimated that some 70 ft. of strata are missing from the column in N.S.16.

There is no evidence of any igneous activity throughout the entire field.

The Coal Seams.

Within the drilled area and excluding (because of uncertain correlation) Bore No. N.S.23 nine main coal horizons have been recognised, of which three are considered to be of commercial significance under the conditions specified (minimum thickness 3 ft.). Eight of the seams are contained in less than 430 ft. of strata. The ninth seam (I seam) lies some 500 ft. below H seam, the lowest of the upper group.

Basing his nomenclature on Borehole N.S.8 the District Geologist called the seams, in decending order, A, B, C, D, E, F. Later holes penetrated three lower seams which he called G, H, and I. The correlation of the various coal horizons in relation to spore assemblages is discussed by Dr. de Jersey in Appendix I.

A and B Seams were respectively 3 in. and 14 in. thick in N.S.8. Subsequent boring showed that there were several coal beds above C Seam, none of which was of workable thickness. Definite correlation with A and B Seams has in most cases not been established.

C Seam has the greatest known areal extent, having been identified in every hole except two (See Fig. 2). In all bores thickness ranges from 1 ft. to 5 ft. 5 in. and averages 3 ft. 4 in. It was thickest in the western part of the area and poorest in the eastern holes. C Seam is normally without bands. It is unfortunate that a substantial part of the area within which C Seam reaches its maximum development lies under the wide and deep channel* of Tooloombah Creek. In the deepest part of the channel it is believed the cover over the seam may be as little as 50 ft. or even less. To make matters worse there are, as has already been stated, indications of a major fault which in all probability strikes roughly parallel with the course of the creek. This would increase the hazard of working coal under the creek. What proportion, if any, of the coal could be safely extracted from beneath Tooloombah Creek is a matter for the mining engineer, but it seems certain that availability of reserves will be substantially affected by the presence of the watercourse. If C Seam were to maintain a workable thickness right to the 'crop,'' i.e. the surface of unweathered coal, which would be at a vertical depth of 70 ft. or thereabouts, reserves west of Tooloombah Creek would be unimportant. In other directions the limits of workability of C Seam have been determined.

D Seam has not shown a workable section in any of the boreholes, its maximum thickness being 1 ft. 4 in. It lies as a rule about 20 ft. above E Seam. It has been recognised in most bores, usually on lithological and stratigraphical evidence. D Seam often carries two or three stone bands.

E Seam, which lies some 60 ft. above F Seam, has been identified with more or less certainty in eleven of the sixteen holes bored. It included a thick shale band in three bores (N.S.9, N.S.10 and N.S.22), but in surrounding holes showed no tendency to split. As there is some doubt about the practicability of working the seam where split a separate estimate has been made of reserves outside the area where the band occurs. The workable area of E Seam is somewhat irregular in shape but shows a pronounced north-west–south-east trend. The best section was in one of the most southerly holes, N.S.21, where there was 5 ft. 4 in. of clean coal.

There is a divergence of opinion between the District Geologist and Dr. de Jersey as to the identity of the 5 ft. 6 in. seam of coal penetrated at a depth of 561 ft. 6 in. in N.S.23. If it is, as Dr. de Jersey believes, E Seam, there are prospects of important reserves to the south and south-east of the bored area.

A relatively small proportion of the reserves in E Seam lie under Tooloombah Creek. As the solid cover would in general be less than 300 ft. total extraction of the coal would probably be impracticable and for this reason a separate estimate has been made of reserves east of the creek.

F Seam has shown workable sections in seven of the twelve holes in which it has been identified. The stratigraphic interval between it and G Seam varies from 15 ft. 6 in. to 21 ft. The greatest thickness penetrated was 4 ft. (in N.S.9, N.S.11 and N.S.13). Workable limits have been reached in the north-west and east but not yet in the south.

G Seam was first recognised by the field geologist in bore No. N.S.9 at 513 ft. 7in. where it was 20 ft. above H Seam. In view of its relative insignificance Dr. de Jersey did not make any special study of the spore distribution. The only hole where correlation seems of importance is N.S. 14 where a 4 ft. section of coal at 572 ft. 1 in. was identified in the field as G Seam. Should this in fact prove to be F Seam, as it may well do, reserves in the latter would be considerably increased. Excluding N.S.14 the greatest thickness of G Seam as recognised by the field geologist is 2 ft. 11 in. in N.S.9.

H Seam is the lowest of the upper group and is separated from I Seam by 500 ft. of barren strata. The thickest section measures 2 ft. 9 in. including stone bands. It has been recognised (on stratigraphic evidence only) in four boreholes.

I Seam is the lowest and thickest of the seams penetrated in the campaign. It has been identified for certain in only two of the five holes that were bored deep enough to intersect it.

In N.S.11 I Seam was reported by the driller to be 8 ft. thick. Core recovery was only 41 per cent. and the material (which included no stone) was all in a finely broken condition. Because of the poor recovery this seam was not analysed.

In N.S. 16, situated 40 chains to the north there were two seams separated by 9 ft. 6 in. of shale in the expected position of I Seam. The top seam was reported by the driller to be 4 ft. thick. The core

* The outer banks are 30 chains apart in the vicinity of bore No. N.S.10.

TABLE I.

Seam Correlation, and Analytical Data.

N.S. Bore No.	Coal Section Depth.	Seam.	Seam Thickness.	Recovery.	G.S. Sample No.	Proximate Analysis.				Sulphur.	Calorific Value.		Sp. Gr.	Coking Properties. (A.S.A. Ck. 1949 Standard) Coking Properties. (Australian Standards Association Classification).
						Moist.	Vol. M.	Fix C.	Ash.		Cals/gm.	BTU/lb.		
	Ft. in.–Ft. in.		Ft. in.	Per cent.										
8/1948	182 0–187 5	C	5 5	..	(20/53) 77	3·5	32·6	59·2	4·7	0·36	7,714	13,880	1·341	Class Af., S.I. 1½
	307 3–311 7	E	4 4	..	(21/53) 111	2·0	30·3	57·4	10·3	0·03	7,189	12,940	1·388	Class Af., S.I. 1½
	366 4–369 8	F	3 4	..	112	2·1	29·9	60·4	7·6	0·54	7,432	13,380	..	
9/1948	189 0–191 0	..	2 0	..	218	2·8	32·4	52·4	12·4	0·40	6,940	12,490	..	..
	314 4–319 5	C	5 1	..	(22/53) 219	2·8	30·7	54·1	12·4	0·35	6,950	12,510	1·400	Class Af., S.I. 1½
	336 2–337 11	..	1 9	..	248	1·9	28·7	47·7	21·7	0·50	6,213	11,180	..	..
	415 7–418 4	E	2 9	..	(33/53) 249	2·0	30·3	56·4	11·3	0·56	7,100	12,780	1·383	Class Af., S.I. 1½
	419 3–421 4	E	2 1	..	(34/53) 250	1·9	30·5	59·4	8·2	0·55	7,385	13,290	1·354	Class Af., S.I. 1
	490 4–494 4	F	4 0	..	(35/53) 251	1·7	32·1	58·7	7·5	0·49	7,448	13,400	1·372	Class Af., S.I. 1½
	513 7–516 6	G	2 11	..	252	1·5	31·4	58·6	8·5	0·49	7,427	13,370	..	..
10/1948	146 0–148 0	..	2 0	..	306	2·2	31·6	60·6	5·6	0·43	7,622	13,720	..	
	154 10–158 10	C	4 0	..	(23/53) 307	2·8	32·3	56·4	8·5	0·48	7,241	13,030	1·376	Class Af., S.I. 1½
	262 2–264 5½	..	2 3½	..	386	1·9	26·2	51·0	20·9	..	6,341	11,410	..	
	288 10–290 10	E	2 0	..	387	1·9	30·5	59·2	8·4	..	7,392	13,310	..	
	292 5–292 9	E	0 4	..	..	..	..	..	..	..	..	..	..	
	352 2–354 11	F	2 9	..	385	2·1	31·5	58·9	7·5	..	7,433	13,380	..	
	375 5–376 2	G	0 9	..	..	..	..	..	..	..	..	..	..	
	377 2–377 8	G	0 6	..	..	..	..	..	..	..	..	..	..	
11/1948	439 0–443 0	F	4 0	62·5	(24/53) 388	1·8	32·1	50·6	15·5	..	6,505	11,710	1·423	Class Af., S.I. 1½
	464 0–465 0	G	1 0	..	..	..	..	..	..	..	..	..	..	
	492 0–494 0	..	2 0	100	389	1·8	29·3	60·6	8·3	..	7,254	13,060	..	
	992 0–1,000 0	I	8 0	41	..	..	..	..	..	..	..	..	..	
12/1948	177 4–180 4	..	3 0	100	456	2·9	24·8	39·0	33·3	0·33	5,016	9,030	1·600	
	211 0–215 8	C	4 8	100	(25/53) 457	2·6	31·0	60·2	6·2	0·34	7,484	13,470	1·375	Class Af., S.I. 1½
	330 9–335 0	E	4 3	100	(26/53) 458	2·4	31·7	60·0	5·9	0·68	7,570	13,630	1·362	Class Af., S.I. 1½
	394 6–397 0	F	2 6	60	..	..	..	..	..	..	..	..	..	
13/1949	333 4–337 9	C	4 5	83	(27/53) 63	2·4	31·4	59·8	6·4	0·39	7,524	13,540	1·398	Class Af., S.I. 1½
	352 2–354 2	..	2 0	75	64	2·4	29·9	49·2	18·5	0·44	6,486	11,670	1·433	
	429 4–430 4	E	1 0	..	..	..	..	..	..	..	..	..	..	
	510 0–505 0	F	4 0	100	(28/53) 187	2·1	30·6	56·6	10·7	0·44	7,191	12,940	1·388	Class Af., S.I. 1½
	520 6–521 6	G	1 0	..	..	..	..	..	..	..	..	..	..	
	1,040 6–1,044 6	I	4 0	33	..	..	..	..	..	..	..	..	..	
	1,054 0–1,063 0	I	9 0	88	311	1·5	27·9	55·4	15·2	0·39	6,938	12,490	..	
14/1949	379 8–380 3	C	0 7	..	..	..	..	..	..	..	..	..	..	
	383 10–384 8	C	0 10	..	..	..	..	..	..	..	..	..	..	
	477 0–477 7	E	0 7	..	..	..	..	..	..	..	..	..	..	
	477 11–478 2	E	*0 3*	..	..	..	..	..	..	..	..	..	..	

Hard grey non-swelling coke.

15/1949	270 0–271 0	C	1 0	..	..	..	..	..	..	..	..	..	..	..	
	272 6–273 0	C	0 6	..	..	..	..	..	..	..	..	..	..	..	
	274 6–275 6	C	1 0	..	..	..	..	..	..	..	..	..	..	..	
	389 9–394 0	E	4 3	94	(36/23) 346	2·3	32·9	55·3	9·5	0·56	7,272	13,090	1·370	Hard grey coke Class Af., S.I. 1½
	429 3–430 1	F	0 10	..	..	..	..	..	..	..	..	..	..		
	558 0–560 3	..	2 3	100	522	2·3	29·5	54·1	14·1	0·36	6,741	12,220	1·455		
16/1949	146 9–151 9	C	5 0	80	519	2·6	32·4	56·5	8·5	0·41	7,120	12,820	1·398	Hard grey good quality coke	
	341 7–345 8	F	4 1	80	523	2·6	21·9	34·7	40·8	0·31	4,402	7,920	1·627		
	359 0–361 6	G	2 6	80	524	2·0	30·7	52·3	15·0	0·44	6,572	11,830	1·410		
17/1949	375 6–379 4	C	3 10	81	331	2·4	31·3	55·1	11·2	0·36	6,960	12,520	1·414	Non-swelling good quality coke	
	445 0–447 3	..	2 3	88	332	2·4	29·9	57·0	10·7	0·57	7,140	12,840	1·386		
	464 9–466 11	E	2 2	88	333	2·3	28·5	49·5	19·7	2·0	6,390	11,500	1·483	Slightly swelling good quality coke	
	479 3–480 6	E	1 3	..	..	..	..	..	..	..	..	..	..		
	542 6–542 10	F (?)	0 4	..	..	..	..	..	..	..	..	..	..		
18/1950	149 0–152 6	..	3 6	60	169	2·2	28·7	50·6	18·5	0·42	6,356	11,440	1·435		
	156 0–159 0	..	3 0	50	170	2·3	28·1	51·5	18·1	0·39	6,402	11,460	1·431		
	181 5–182 0	C	0 7	..	..	..	..	..	..	..	..	..	..		
	191 0–191 5(?)	C	0 5	..	..	..	..	..	..	..	..	..	..		
	318 0–321 8	E	3 8	30	171	2·1	27·2	46·9	23·8	1·05	5,936	10,680	1·490		
	373 0–374 9	F	..	..	..	..	..	..	..	..	..	..	..		
	410 10–413 0	..	2 2	70	172	1·9	30·2	60·5	7·4	0·53	7,344	13,220	1·353		
19/1950	464 2–465 8	C (?)	1 6	..	..	..	..	..	..	..	..	..	..		
	595 9–596 1	E (?)	0 4	..	..	..	..	..	..	..	..	..	..		
20/1951	452 4–453 8	C	1 4	..	..	..	..	..	..	..	..	..	..		
	633 3–635 9	F	2 6	66	330	1·9	29·3	57·3	11·5	0·62	7,125	12,830	1·377		
21/1951	230 9–232 0	C (?)	1 3	..	..	..	..	..	..	..	..	..	..		
	342 9–348 1	E	5 4	75	400	2·9	29·8	56·3	11·0	0·68	6,982	12,560	1·370	S.I. 5 class Cw.	
	419 2–422 10½	F	3 8½	61	(29/53) 462	1·9	30·6	59·7	7·8	0·48	7,430	13,350	1·351	Class Af., S.I. 1½	
22/1951	261 8–263 4	C	1 8	..	..	..	..	..	..	..	..	..	..		
	269 10–272 10	C	3 0	94	(32/53) 463	2·2	33·0	57·8	7·0	0·47	7,422	13,360	1·350	Class Cw.,S.I. 1½	
	364 0–366 8	E	2 8	22	(30/53) 464	2·0	32·5	58·2	7·3	0·68	7,450	13,410	1·340	Class Af., S.I. 2½	
	368 5–370 5	E	2 0	54	(31/53) 465	2·3	30·1	53·1	14·5	0·54	6,774	12,190	1·405	Class Af., S.I. 1½	
23/1951	365 3–367 0	C	1 9	..	..	..	..	..	..	..	..	..	..		
	374 0–376 2	C	2 2	100	527	3·5	28·7	54·0	13·8	0·40	6,714	12,080	1·392		
	483 6–483 9	E	0 3	..	..	..	..	..	..	..	..	..	..		
	492 0–493 0	E	1 0	..	..	..	..	..	..	..	..	..	..		
	561 6–567 0	F	5 6	38	528	2·6	29·0	54·4	14·0	0·40	6,736	12,120	1·412		
	589 2–590 8	G (?)	1 6	..	..	..	..	..	..	..	..	..	..		

was finely broken and recovery was only 33 per cent. The bottom seam was 9 ft. thick and was without shale bands.

A band of coal 4 in. thick at 862 ft. in N.S.18 is believed on stratigraphic evidence to be on about the same horizon as I Seam. It is possible that I Seam itself is missing from this section due to overlap.

I Seam was missing in N.S.12 and N.S. 16 both of which were carried to basement. The two bores, however, bottomed on a bedrock "high" and the absence of I Seam is attributable to overlap.

Lying as it does close to the uneven bedrock surface, and for this reason liable to interruption due to overlap, I Seam, though by far the thickest of the seams intersected in this area, loses much of its attractiveness.

The Coal.

The Styx coals are all of a similar type and rank. They are made up of alternating thin bands of durain and vitrain with a high spore content. The coal is hard and there is no very pronounced cleat.

Fixed carbon percentage of a few selected bore samples indicates that the coal is of similar rank throughout. It is a high-volatile bituminous coal. Coking tests show that the Tooloombah Creek coals form in general a hard, grey non-swelling coke with a swelling index of 1½. In the Australian Standards Association classification (A.S.A. CK2, 1949) the coke falls in the Af category. Industrially the coal may be said to be non-coking.

The inherent mineral matter in the coal is moderately low, average ash values for the workable seams being as follows:—C Seam 8·7 per cent., E Seam 11·0 per cent., F Seam 10·1 per cent. Calorific values range from 10,680 B.T.U. (23·8 per cent. ash) to 13,880 B.T.U. (4·7 per cent. ash). Sulphur is low at less than 0·5 per cent. (average), though one sample showed 2 per cent. Moisture ranges from 1·5 per cent. to 3·5 per cent. and averages about 2 per cent. Full analytical details are given in Table I. (*See also Fig.* 3.)

Reserves.

Reserves have been estimated for three seams, C, E and F. The reserves have been calculated as a function of average specific gravity and volume. Measured reserves only have been calculated. In view of the characteristically lenticular habit of the seams, coal of workable thickness has been assumed to extend no more than ten chains beyond points of observation—in most cases 5 chains is the limit selected. For the same reason no estimate of indicated reserves has been made. The boring indicates in a general way that little additional coal is to be expected north and west of the bored area. On the other hand the country to the south and south-east is regarded as most promising.

Tables II. and III. set out all the relevant data pertaining to reserves. What follows is explanatory of these tables.

TABLE II.

COAL RESERVES, BASED ON A MINIMUM COAL THICKNESS OF 3 FT.

Seam.	Area.	Average Coal Thickness.	Tonnage per Acre/Ft.	Total Measured Reserves.	Coal E of E bank of Tooloombah Creek and included in total reserves.			Coal E of E bank of Tooloombah Creek (excluding split portion of E seam) included in total reserves.			Cover Over Seams E of E bank of Creek.	
					Area.	Average Thickness.	Quantity.	Area.	Average Thickness.	Quantity.	Minimum.	Maximum.
	Acres.	Feet.		Tons.	Acres.	Feet.	Tons.	Acres.	Feet.	Tons.	Feet.	Feet.
C	245	4·15	1,676	1,708,000	161	4·14	1,119,000	..	..	..	118	400
E	226	3·84	1,680	1,460,000	181	3·92	1,193,000	95	3·82	610,000	297	437
F	147	3·49	1,677	860,000	147	3·49	860,000	..	..	..	353	590
Total	..	..	..	4,028,000	..	..	3,172,000	..	..	..	..	..

TABLE III.

PORTION OF RESERVES WITH A MINIMUM COAL THICKNESS OF 4 FT. INCLUDED IN TABLE II.

Seam.	Area.	Average Thickness.	Tonnage per Acre/Ft.	Measured Coal Reserves 4 feet and over.	Coal E of E bank of Tooloombah Creek included in reserves, 4 feet and over.			Coal E of E bank of Tooloombah Creek and excluding split section of E seam included in reserves, 4 feet and over.		
					Area.	Average Thickness.	Quantity.	Area.	Average Thickness.	Quantity.
	Acres.	Feet.		Tons.	Acres.	Feet.	Tons.	Acres.	Feet.	Tons.
C	149	4·58	1,676	1,143,000	98	4·55	746,000	..	..	..
E	108	4·40	1,680	798,000	95	4·43	705,000	43	4·39	318,000
F	..	..	..	..	..	..	..	..	..	..
Total ..	..	..	..	1,941,000	..	..	1,451,000	..	..	..

C Seam. Where the limits of workability of C Seam have been defined by boring isopachs have been constructed on the assumption that there is a constant decrease in seam thickness. Where the outer drillholes still showed workable thicknesses of coal the isopachs have been extended beyond the holes unless the coal thickness approached the lower limit of a particular category. Where the thickness of the seam exceeded 5 ft. in any hole the 3 ft. isopach has been extended by 10 chains; otherwise it has been extended by only 5 chains. The 4 ft. isopach has been extended by 5 chains unless the seam thickness barely exceeded 4 ft.

Because of uncertainties regarding extraction of coal beneath the channel of Tooloombah Creek a separate estimate has been made of reserves east of the east bank of that watercourse.

E Seam. As in the case of C seam reserves in E Seam fall into two categories based on coal thickness, namely with minimum coal thickness of 3 ft. and minimum coal thickness of 4 ft.

The reserves lie in part beneath the channel of Tooloombah Creek, and, while the cover is rather thicker than in the case of C Seam, the extractability of the coal is likely to be affected to some extent. Accordingly a separate estimate has been made for the area east of the east bank of the creek. Availability of reserves may be further restricted by a split which occurs in the seam in the southern part of the bored area and separate calculations have been made excluding the split coal from the reserves lying east of Tooloombah creek.

The most southerly holes showed E Seam at its best and there is every reason for expecting an extension of reserves in this direction. Should the seam between 561 ft 6 in. and 567 ft. in the scout hole No. N.S.23 the identity of which is in some doubt, eventually prove to be E seam, the reserves will be greatly augmented.

F Seam. There are no reserves of coal with a minimum thickness of 4 ft. in F Seam. The seam attained a thickness of 4 ft. in three holes (N.S.9, N.S.11 and N.S.12) which, however, were co-linear and so no area could be calculated. F Seam had a thickness of 3 ft. 1 in. in N.S.16, which is located within the Channel of Tooloombah Creek and near the outer west bank, but even though the seam was without stone bands it had a prohibitively high ash content and for this reason the hole has not been used in estimating reserves.

I Seam. Workable coal in I Seam has been penetrated in only two bores. Hence no reserves can be calculated. Because of its nearness to bedrock in the bores which have pierced it and because the drilling has revealed considerable unevenness in the bedrock surface, continuity of the seam over any considerable area could not be counted on. However, the thickness of the seam is such that its extension over a relatively small area would ensure mineable reserves. For example if a thickness of 8 ft. were maintained over only 50 acres reserves would exceed half a million tons.

Conclusion.

It has been the aim of the foregoing report to present all data essential for the estimation of reserves. Figures have been given of the total measured reserves and it has been indicated that there are good prospects of additional reserves outside the bored area. It has also been pointed out that from various causes availability of reserves so far proved is likely to be restricted. Separate estimates have been given of probable available reserves.

It must be emphasised that the campaign has not yet been completed. By December, 1951, when the last hole, N.S.23, was completed the crisis at the State Mine had eased and as the plant was urgently required elsewhere, drilling at Toolombah Creek was suspended. However, before any decision is taken as to the eventual location of a new pit to exploit the Tooloombah Creek seams it is considered essential that further boring should be carried out south and east of the bored area.

The area already drilled, because of the unsuitability of the terrain and (still more important) because of the difficulty of access, does not commend itself as a site for a new pit. If one of the seams (not, of course, including I Seam) could be proved to persist in a workable condition sufficiently far to be conveniently reached by a stone drift commenced east of Deep Creek it might be possible to haul all the coal through such an opening and so avoid the necessity of establishing a colliery in the Tooloombah Creek area. This would be the main purpose of resuming drilling here. It would also aim at establishing the identity of the 5 ft. 6 in. seam in the scout hole (N.S.23) and, of course, the proving of additional reserves.

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APPENDIX 1.

Microspore Correlation, Styx Coalfield.

By N. J. de Jersey, Ph.D., M.Sc.

Introduction.

This report is an account of the application of microspore correlation in the recent drilling campaign on the Styx coalfield. Drilling was carried out during the period February, 1948 to December, 1951 in an area near Tooloombah Creek (see locality map), the aim being to prove reserves for development at a later date. In all 16 bores were drilled, their surface lay-out being in the form of a 20-chain grid. At an early stage in the drilling campaign, difficulties were encountered in seam correlation. These difficulties were due mainly to the lenticularity of the seams, lack of reliable marker beds and uncertainty as to the direction and amount of true dip. The investigation of microspore distribution described in this report was commenced in 1950 to assist in correlation of the principal seams encountered in drilling. After completion of basic work involving description of spore types and recognition of spore assemblages characteristic of certain seams, the method was applied to establish correlation of the principal seams as drilling progressed, the results being used in conjunction with stratigraphical evidence.

Method of Investigation.

The investigation was based on core samples from all the bores with the exception of N.S.14, for which no samples were available. For Bores N.S.8-13 inclusive, samples were available from all coal sections over 2 ft. in thickness; for the later bores (N.S. 15-23 inclusive) samples were kept from all coal sections down to a minimum thickness of 2 in. In several cases samples from these thinner sections proved useful in tracing seams as they thinned laterally.

Microscopic study of the crushed samples indicated that in most cases they consist largely of bright coal (clarain and vitrain), with only small proportions of durain and shale bands. As work in England (Raistrick 1939, pp. 425-431) has shown that variations in the durain content of a seam may influence its microspore assemblage, the influence of durain was eliminated by rejecting this constituent when taking samples for maceration. In this way comparison of the microspore assemblages of different seams was based on samples consisting uniformly of bright coal. The samples available were reduced by quartering to samples of the order of ½ lb., which after removing durain and shale bands were crushed to pass a 20-mesh sieve. Dust and finely-crushed material were then removed by screening with a 40-mesh wire sieve, and 2-4 gm. of the resulting granular sample was taken for treatment.

The maceration technique employed was similar to that described previously (de Jersey 1946, p.2). Three slides were prepared for each sample and examined in detail, approximately 500 microspores being classified and counted. In this way the percentage of each microspore type of the total counted in any sample could be estimated to the nearest 0.2 per cent.

Descriptions of Microspore Types.

In description of the microspore types the classification used for the Burrum coalfield (de Jersey 1951, p. 782) was adopted. In all 38 types have been distinguished, of these 27 have been previously described from the Burrum coals (de Jersey 1951, pp.782-7). The large proportion of spore types common to the two coalfields is a reflection of their approximate equivalence in time of deposition, as both formations are of Cretaceous age. The proportion of spore types restricted to each formation of coal measures suggests either that they were laid down at slightly different times within the Cretaceous or that certain types were restricted to the local environment in each case. The spore types previously described from the Burrum coals are as follows (for detailed descriptions reference should be made to the report cited): C1C, C1D, C1E, C1F, C1G; C1H, C2E, C2F, C2G, C2I, C3C, C7F, C8B, C11A, C11B, C11D, C12A, C12B, C12D, C13C, C13D, C13E, C38B, C47A, C47B, C46A.

The remaining eleven types are new and previously undescribed. They are described below in detail and illustrated by photographs in Plate 1.

Type C1I.—Angular tetrahedral; well defined apices, flat or slightly convex sides; triangular outline. Size 17-35 microns from apices of tetrahedron to opposite sides. Trilete; broad triradiate sutures up to 5 microns in width and usually closed, extend to distal apices. Exine psilate, colourless to light yellowish brown.

Type C2J.—Sub-angular tetrahedral; rounded apices; convex sides; ill-defined triangular outline. Trilete; short ill-defined sutures, open near proximal apex, extend about half-way to margin in proximal view. Well-defined contact area of average diameter 5 microns. Size 13-21 microns from apices to opposite sides in proximal view. Exine psilate, pale yellow to light yellowish brown.

Type C4E.—Spheroidal with flattened proximal and distal sides. Circular outline in axial view. Trilete with closed sutures usually extending from centre to margin in proximal view. Diameter 7-20 microns. Exine psilate, colourless to light yellowish brown.

Type C6C.—Angular tetrahedral; well defined apices; flat or slightly convex sides; triangular outline. Trilete with well defined, usually closed sutures extending to distal apices. Size 12-40 microns from

All Figures X850.

Plate 1.—Spores from Tooloombah Creek Area, Styx Coalfield.

apices of tetrahedron to opposite sides. Exine granulate, of fine to medium granular texture (granulations 0.5-1 micron in diameter) pale yellow to light brown.

Type C6D.—Angular tetrahedral; well defined apices; flat or slightly convex sides; triangular outline. Trilete with narrow, usually closed sutures extending to distal apices. Size 23-42 microns from apices of tetrahedron to opposite sides. Exine granulate, of fine to medium texture (granulations 0.5-1 micron in diameter), pale yellow to light yellowish brown. Three thickened ridges, 2 to 7 microns in width, and one to each of proximal faces, run parallel to distal interfaces.

Type C7G.—Sub-angular tetrahedral, rounded apices; convex sides; ill-defined triangular outline. Trilete; sutures usually closed and extending to distal apices. Size 29-40 microns from apices of tetrahedron to opposite sides. Exine granulate, of fine to medium granular texture (granulations 0.5-1 micron in diameter), pale yellow to light yellowish brown.

Type C7H.—Sub-angular tetrahedral; rounded apices; convex sides; ill-defined triangular outline. Trilete; sutures usually closed and extending halfway to distal apices. Prominent contact area, 10 to 16 microns in diameter at proximal apex. Size 17-31 microns from apices of tetrahedron to opposite sides. Exine granulate, of fine to medium granular texture (granulations 0.5-1 micron in diameter) light yellow to light brown.

Type C8C.—Ellipsoidal, ellipse of low eccentricity; suboval outline. Monolete; narrow closed longitudinal suture extends full length of body. Length 15-31 microns, width in lateral view 12-25 microns. Exine granulate, of fine to medium granular texture (granulations 0.5-1.5 micron in diameter) light yellowish brown to dark brown.

Type C8D.—Ellipsoidal. Monolete; broad longitudinal suture 5-10 microns in width, extends full length of body. Length 23-40 microns, width in lateral view 12-24 microns. Exine granulate, of fine to medium granular texture (granulations 0.5-1 micron in diameter), light yellow to light brown.

Type C18C.—Ellipsoidal, with rounded ends. Monolete with longitudinal suture extending for greater part of length or occasionally with longitudinal collapsed area. Length 25-45 microns, width 12-25 microns. Exine light yellowish brown to dark brown, echinate with small spines 1 to 3 microns in length, 0·5-1·5 microns wide at base, set 1 to 3 microns apart.

Type C47C.—Spore consisting of two flanges. Large flange rounded, somewhat sub-triangular in shape and usually with closed trilete sutures, often indistinct; to one side of this is attached a small sub-triangular flange. Diameter of larger flange 17-37 microns; smaller flange 17-35 microns (length of junction with larger flange) 5-17 microns (width from free apex to junction line). Exine pale yellow to light brown, finely granulate with granulations 0·5-1 micron in diameter.

CORRELATION OF COAL SEAMS.

Introduction.

As stated above, study of spore distribution was based on percentages determined from counts of 500 spores for each sample. Study of the results indicated that several of the most abundant types were also abundant in the Burrum coals; these types were long-ranged and of little correlative value, their distribution showing no significant changes through the succession. On the other hand, several of the less abundant types are short-ranged or show significant changes in abundance; prominent among these types are those which are restricted to the Styx coalfield. In applying spore distribution to seam correlation, special attention was given to the latter group on account of the stratigraphical importance of the spore types concerned.

Study of the distribution of this group of spore types provided a basis for correlation of the principal seams in the area. Evidence on lateral changes in spore distribution was obtained by studying spore assemblages in samples from the same seam in different bores (correlated by independent stratigraphic evidence). It became clear from such evidence that although some of the longer-ranged types change laterally in abundance, the shorter-ranged types used for correlation are not affected to any important extent by lateral variation in distribution.

The application of spore distribution to seam correlation is summarised below by including under each of the principal seams, a description of the spore assemblage characteristic of the seam and a list of the depths at which it was encountered in the bores.

The nomenclature used in description of the seams is taken from a preliminary report on the drilling campaign by S. R. L. Shepherd, District Geologist (1950). The nine principal seams have been described as the A to I seams from the highest downwards. The type locality for each seam may be taken as its section in the bore in which it was first recognised. In the following table (Table 1) the seams are listed with their thicknesses and depths at such type localities.

TABLE 1.

Depths and Thicknesses of Seams at Type Localities.

Coal Seam.	Bore Number.	Depth to Top of Seam.	Thickness of Coal.
		Ft. in.	Ft. in.
A	N.S. 8	70 0	3
B	N.S. 8	84 6	1 2
C	N.S. 8	182 0	5 5
D	N.S. 8	277 10	2 1
			(in four sects.)
E	N.S. 8	307 3	4 4
F	N.S. 8	366 4	3 2
G	N.S. 9	513 7	2 11
H	N.S. 8	415 6	2 9
			(in two sects.)
I	N.S. 11	992 0	8 0

Descriptions of Spore Assemblages in the Principal Seams.

"I" Seam.—This seam is the lowest major seam which has been proved in the area. The characteristic feature of the spore assemblage is the rarity of type C2E. This type which forms 1·8 per cent. of the total in the sample from N.S. 11 and 0·4 per cent. in that from N.S. 13, varies from 4·1 to 20·0 per cent. in the upper seams. Other distinctive features are the presence of type C11B, which is absent in the upper seams, and the absence of type C4E.

Samples from this seam which have been studied came from Bore N.S. 11, 992 ft., and Bore N.S. 13, 1,054 ft. A four-inch section at 862 ft. in N.S. 18 may also be correlated with this seam on stratigraphic evidence.

"H" Seam.—The "H" seam is at an average interval of about 500 ft. above the "I" seam. It is relatively thin and impersistent and is known from the bores as follows: N.S. 8, 415 ft. 6 in.; N.S. 11, 492 ft.; N.S. 16, 398 ft. 11 in.; N.S. 18, 410 ft. 10 in.

The spore distribution has been studied in samples from Bores N.S. 8 and N.S. 18. The seam is distinguished by the presence of type C4E, absent in the "I" seam, and by the absence of type C1I and C11B. Spore type C7G, which is present in some of the higher seams, is also absent.

The sections in Bores N.S. 11 and N.S. 16 have been correlated with this seam on stratigraphic grounds (Shepherd 1950, Table 1).

"G" Seam.—This seam is approximately 20 ft. above the "H" seam. It is relatively thin and impersistent and was first recognised in Bore N.S. 9 at 513 ft. 7 in. Shepherd (1950, Table 1) has correlated sections in Bores N.S. 10, N.S. 11, N.S. 14 and N.S. 16 with this seam on lithological evidence. On account of its minor economic importance no detailed study has been made of the spore distribution.

"F" Seam.—This relatively persistent seam is at an horizon 20 to 50 ft. above the "G" seam. It is known from the various bores as follows: N.S. 8, 366 ft. 4 in.; N.S. 9, 490 ft. 4 in.; N.S. 10, 352 ft. 2 in.; N.S. 11, 439 ft.; N.S. 12, 394 ft. 6 in.; N.S. 13, 501 ft.; N.S. 15, 429 ft. 3 in., 436 ft. 3 in.; N.S. 16, 341 ft. 7 in.; N.S. 17, 561 ft. (?); N.S. 18, 373 ft.; N.S. 20, 633 ft. 3 in.; N.S. 21, 419 ft. 2 in.; N.S. 23, 641 ft.

The following samples were selected from the above for detailed study: N.S. 9, 490 ft. 4 in.; N.S. 13, 501 ft.; N.S. 15, 429 ft. 3 in.; N.S. 16, 341 ft. 7 in.; N.S. 20, 633 ft. 3 in.; and N.S. 21, 419 ft. 2 in.

This seam is difficult to distiguish from the G and H seams below it on the basis of its spore assemblage, which has undergone little change from the H to F seam. There is, however, a marked difference in spore assemblages from the "E" seam above, spore type C7F which is fairly rare in the F seam (average below 1·0 per cent.) averages 3 to 4 per cent. of the total in the E seam; spore type C8B similarly is approximately half as abundant as in the E seam. Other features of correlative value are the absence of type C6C and of types C7G and C7H.

In Bore N.S. 15 stratigraphic evidence suggests that the seam is split into two sections 7 ft. apart. The correlation of the upper section with the F seam is confirmed by its spore assemblage. The spore distribution was studied in one section only as the thinning of the seam minimises its economic importance in this bore.

The correlation of the sections not studied in detail for spore distribution was established by studying their spore assemblages with special reference to the types used for distinguishing the seam. The doubtful correlation of the section in N.S. 17 was based on stratigraphic evidence only.

"E" Seam.—The E seam is also persistent over most of the area drilled and is approximately 60 ft. above the F seam. It is represented in the bores as follows: N.S.8, 307 ft. 3 in.; N.S.9, 415 ft. 7 in.; N.S.10, 288 ft. 10 in.; N.S.22 (N.S.11 redrilled), 364 ft.; N.S.12, 330 ft. 9 in.; N.S.15, 389 ft. 9 in.; N.S.17, 464 ft. 9 in. (?), 470 ft. (?), 479 ft. 3 in.; N.S.18, 318 ft. 0 in.; N.S.21, 342 ft. 9 in.; N.S. 23, 561 ft. 6in. The following samples have been studied in detail: N.S. 8, 307 ft. 3 in.; N.S.9, 415 ft. 7 in.; N.S.22 (N.S.11 redrilled), 364 ft.; N.S. 12, 330ft. 9 in.; N.S. 17, 479 ft. 3 in. and 464 ft. 9 in.; N.S.18, 318 ft.; N.S.21, 342 ft. 9in. and N.S.23, 561 ft. 6 in.

The characteristic features of the spore assemblage have already been discussed above under the F seam. Spore types C7F and C8B here reach their maximum abundance (of the order of 3 per cent. and 14 per cent. respectively). In addition type C6C which is present, is rare or absent in the F seam, and types C7G and C7H, which are found in the higher seams, are absent.

In Bore N.S.17, stratigraphic evidence suggests that the seam is split into three sections. The spore distribution has been studied in two of these sections (from 464 ft. 9 in. and 479 ft. 3 in.) of which the latter had the characteristic assemblage of the E seam. The upper section (at 464 ft. 9 in.) showed less similarity to the E seam assemblage. However, this does not preclude correlation with this seam, as no detailed study has been made of the effect of seam splitting on the spore assemblages. As the seam is of little economic importance in this bore the problem was not investigated further.

Bore N.S.23 is in a relatively isolated position 40 chains east of Bore N.S.21. This distance, which is twice the normal grid interval (20 chains) renders correlation difficult by normal stratigraphical methods, on account of uncertainty as to average dip,

faulting and distribution of marker beds. On such evidence the seam at 561 ft. 6 in. in N.S.23 may be either the E or F seam. Accordingly the spore content of this sample was investigated. The assemblage present was similar to that characteristic of the E seam in other bores, rather than to that from the F seam. This section is thus regarded as representing an easterly extension of the E seam. This correlation is supported by the assemblages of samples from the seams above and below. A sample from the seam above (at 483 ft. 6 in.) had an assemblage different from the E seam and intermediate between the C and E seams, while the seam below had the F seam assemblage. (See above under F seam.)

"D" Seam.—This seam, which is relatively thin and unimportant, is approximately 20 ft. above the E seam. In several bores it is split into two or three coal sections separated by thin layers of shale. The thicker, more important, sections are as follows: N.S.8, 277 ft. 10 in.; N.S.9, 388 ft. 8 in.; N.S. 10, 262 ft. 2 in.; N.S. 12, 310 ft. 11in.; N.S.13, 401 ft. 10 in.; N.S.15, 371 ft. 4 in.; N.S.16, 251 ft. 6 in. and 256 ft. 5 in.; N.S.17, 445 ft. and N.S.18, 247 ft 6in. There are also several other sections which are probably split sections of this seam. Spore assemblages from the following samples have been studied in detail: N.S.16, 256 ft. 5 in.; N.S.17, 445 ft. and N.S.18, 297 ft. 6 in. The correlation of the remaining sections is based on lithological evidence (Shepherd 1950, Table 1).

The spore assemblage of the D seam is characterised by the presence of types C6C, C7G and absence of type C4E. The proportion of type C8B is approximately the same as in the E seam. The principal feature enabling distinction from the E seam is the presence of type C8C.

"C" Seam.—The C seam is persistent over most of the area drilled and is approximately 90 ft. above the D seam. It is represented in the bores as follows: N.S.8, 182 ft.; N.S.9, 314 ft. 4 in.; N.S. 10, 154 ft. 10 in.; N.S.12, 211 ft.; N.S.13, 333 ft. 4 in.; N.S. 16, 146 ft. 9 in.; N.S. 17, 375 ft. 6 in.; N.S. 18, 181 ft. 5 in., and 191 ft.; N.S.21, 230 ft. 9 in. The following samples have been studied in detail: N.S.8, 182 ft.; N.S.9, 314 ft. 4 in.; N.S. 10, 154 ft. 10 in.; N.S.13, 333 ft. 4 in.; N.S.16, 146 ft. 9 in.; N.S.17, 375 ft. 6 in.; N.S.18, 181 ft. 5 in.

The spore assemblage of the C seam can be distinguished from that of the lower seams by the presence of types C7G, C7H and C4E each forming 1–2 per cent. of the total, and by the absence of types C11B, C8C and C47C. Type C7F is much less abundant than in the E seam. No detailed study has been made of the spore assemblages of the seams above this seam, so that lithological evidence is necessary in cases where it is necessary to distinguish the C seam from the upper seams. Consequently correlation has been based on the change in spore assemblage over the interval of approximately 90 ft. between the D and C seams.

"A" and "B" Seams.—These two seams above the C seam are relatively thin and lenticular and no detailed study has been made of their spore content. In this part of the succession there are several other thin lenticular seams, none of which are of economic importance in the area drilled.

Summary of Results.—In the accompanying table (Table 2) the results of microspore correlation in the area drilled are summarised for the principal seams. For the sake of completeness, results are included for several sections which were not studied in detail, as the correlation was well established by lithological evidence. In cases where only a doubtful correlation could be made, the depth is given with a question mark, and where the seam is not represented or there is no reliable correlation, the section is omitted.

The results for bores N.S.11 and N.S.22 have been combined in one column, as N.S.22 was drilled close to the site of N.S.11 to check recovery of coal sections in the earlier bore. Two bores have not been included in the table; they are N.S.14 and N.S.19. Bore N.S. 14 is omitted because no samples were available for study of spore distribution; in the case of N.S.19, no samples were studied in detail as no section of workable thickness was encountered.

Sections representing the A, B, G and H seams have not been listed in the table. On account of the lesser importance of these seams due to their thinness and lenticularity, their spore assemblages were not studied in detail. Correlation of these seams is largely based on lithological evidence and is consequently outside the scope of this report.

Depths given in the table are based on the geologist's log of each bore.

Acknowledgments.

The writer wishes to thank Professor W. H. Bryan, of the Geology Department, University of Queensland, for facilities provided for the photographing of spore types; and also Mr. E. V. Robinson and Mr. A. Crawfoot, of the Geology Department, for assistance in the photographic work.

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TABLE 2.

SUMMARY OF CORRELATION BASED ON SPORE DISTRIBUTION.

Seam.	Bore N.S. 8.	N.S. 9.	N.S. 10.	N.S. 11 (including N.S. 22 to depth of 380 feet).
C	Ft. in. Ft. in. 182 0—187 5	Ft. in. Ft. in. 314 4—319 5	Ft. in. Ft. in. 154 10—158 10	Ft. in. Ft. in. 261 8—263 4 } N.S.22 269 10—272 10 }
D	277 10—278 11 281 11—282 4 282 8—282 11	384 9—385 9 388 8—390 0 393 8—394 1	259 6—260 6 262 2—264 5 ..	338 7—340 4 N.S.22 .. ..
E	307 3—311 7 ..	415 7—418 4 419 3—421 4	288 10—290 10 292 5—292 9	364 0—366 8 } N.S.22 368 5—370 5 }
F	366 4—369 8	490 4—494 4	352 2—354 11	439 0—443 0 N.S.11
I	..	..	..	992 0—1,000 0 N.S.11

Seam.	N.S. 12.	N.S. 13.	N.S. 15.	N.S. 16.	N.S. 17.
C	Ft. in. Ft. in. 211 0—215 8	Ft. in. Ft. in. 333 4—337 9	Ft. in. Ft. in. 270 0—271 0 272 6—273 0 274 6—275 6	Ft. in. Ft. in. 146 9—151 9	Ft. in. Ft. in. 375 6—379 4 .. ..
D	310 11—312 9 ..	401 10—403 0 ..	366 0—366 10 371 4—372 2	251 6—252 10 256 5—258 2	445 0—447 3 ..
E	330 9—335 0	429 4—430 4 ..	389 9—394 0 ..	.. ..	*464 9—466 11(?) 479 3—480 6
F	394 6—397 0 ..	501 0—505 0 ..	429 3—430 1 436 3—437 0	341 7—345 8 ..	.. ..
I	.. ..	1,040 6—1,044 6 1,054 0—1,063 0	.. ..	.. ..	.. ..

Seam.	N.S. 18.	N.S. 20.	N.S. 21.	N.S. 23.
C	Ft. in. Ft. in. 181 5—182 0 191 0—191 5 ..	Ft. in. Ft. in. 425 4—426 4 (?) 432 0—432 4 435 10—436 2	Ft. in. Ft. in. 230 9—232 0	Ft. in. Ft. in. .. ..
D	297 6—299 4	..	322 0—322 6	..
E	318 0—321 8	547 2—547 9	342 9—348 1	561 6—567 0
F	† 373 0—374 9 (?)	633 3—635 9	419 2—422 10½	641 0—641 2 645 5—645 9 648 2—649 0 653 7—655 0 } ‡
I	854 9—855 0 862 0—862 4	.. ..	.. ..	.. ..

* Split section of seam, correlation uncertain (*see text*).

† Not studied for spore content and correlation uncertain on stratigraphic grounds.

‡ Representative sample studied.

APPENDIX 2.

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION.
MINERAGRAPHIC INVESTIGATIONS.

Report No. 532. **15th April, 1953.**

HYDROMICA IN SANDSTONE FROM STYX COALFIELD, QUEENSLAND.

Three pieces of bore core from the Styx Coalfield, Queensland, have been submitted for examination by Mr. C. C. Morton, Chief Government Geologist of Queensland, with a request for the identification of a green mineral in them. The specimens are labelled:— B NS.14/49, 771 ft. 6 in.; D NS.21/51, 120 ft. 6 in.; E NS.20/51, 169 ft., and are of light greenish sandstone. Specimen B, which is coarser grained than the other two, contains abundant grains 0·5 mm. to 1·0 mm. across of a soft green mineral, approaching viridian in colour. Specimens D and E, which are finer grained, can be seen under a binocular microscope, to contain a proportion of the same mineral in grains averaging about 0·25 mm. across, and owe their greenish colour to its presence.

The examination was carried out by Dr. J. McAndrew, who reports as follows:—

In thin section Specimen B is seen to consist essentially of poorly sized angular to sub-angular grains of quartz, quartzite, and occasional fragments of chert and shale, set in a matrix of clay-size grains, and the green mineral, which tends to fill the interstices of the quartz grains. A few grains of felspar were present originally, but tend to be more or less replaced by carbonate.

The green mineral consists of microcrystalline aggregates, with occasional coarser areas, showing cleavage, and a platy form. It is pale green, slightly pleochroic, and bears some resemblance to chlorite, but has a birefringence of approximately 0·020. It has straight extinction, and the cleavage trace is parallel to the slow ray. The refractive index of the slow ray, measured in immersion oils, is about 1·556. These properties indicate that it is not a chlorite.

Two X-ray powder patterns of the mineral were taken, using an 11·46 cm. diameter camera of the design of Parrish and Cisney (1948), which records diffracted beams corresponding to interplanar spacings of up to 20°A, with copper radiation. The patterns obtained bear a general resemblance to the patterns of the hydromica *illite*, as recorded by Grim, Bray and Bradley (1937) and by Mackenzie, Walker and Hart (1948). However, the lowest angle diffraction line was much more diffuse than other low angle lines, and at an angle corresponding to an interplanar spacing of 11·2°A, whereas in illites the the spacing is 10·0±0·2°A, being the 002 basal diffraction.

Silicates which have layer atomic structures show variation in the position and sharpness of the basal diffractions where there is interleaving of two or more types of layers, packed together not in regular repetition, but in random succession (Brindley, 1951).

The X-ray powder patterns of the green mineral indicate that it is of this type. It consists predominantly of layers corresponding to a mica-type layer, of 10°A thickness, interleaved with layers of a greater thickness, which could be either montmorillonite or vermiculite layers (composed of a mica-type layer plus water) or chlorite layers (composed of a mica-type layer plus $Mg(OH)_2$). To distinguish the nature of these interleaved, thicker layers, heating experiments were carried out, with the results shown in Table 1.

On heating to 350°C. the mineral changed to a structure composed completely of mica-type layers. The position of a strong diffraction line at 1·508°A, usually indexed as 060, distinguishes this product as predominantly a dioctahedral type of mica (muscovite type). In predominantly trioctahedral micas (biotite-phlogopite type) this diffraction line is at 1·53°A (Brown, 1951).

Table 1.

Heating.	Appearance of Product.	X-Ray Powder Pattern of Product.
1 hour at 250°C ±10°	Green, very soft, unchanged	Similar to before heating; slight movement to 11.0° A of the line initially at 11.2° A, which remains relatively diffuse
1 hour at 350°C ±10°	Brown, much harder	Corresponds to illite; diffuse line at 11.2°A in unheated mineral replaced by sharp line at 10.2°A
1 hour at 550° C ±10°	Brown, much harder	Corresponds to illite; diffuse line at 11.2°A in unheated mineral replaced by sharp line at 10.2°A

Available data show that the chlorite-type structure does not decompose until heated to 500°–600° C., whereas both the montmorillonite and vermiculite layer types dehydrate irreversibly to a mica-type layer in the range 200°–350° C. The thicker layers interstratified with the mica-type layers are thus shown to be of the composite mica-water type.

The peaks of the X-ray basal diffraction maxima of the hydromica from the Styx Coalfield are at position 11·2°A, 3·36°A and 2·59°A, corresponding to 002, 006 and 008 basal diffractions from the 10°A thick layers in the product after heating. Comparison of these with the graphs of Brown and MacEwan (1951) gave correspondence for all three only for an interleaving of 10°A thick layers with 14°A thick layers, in which the 14°A thick layers comprise about 20 per cent. of the total number of layers.

Two specific layer types are known of thickness about 14°A, the vermiculite type of mica-water layer (Gruner, 1934), and the Ca-Montmorillonite type at an intermediate stage of hydration (Mering, 1946). No attempt has been made to differentiate which of these two layer types is present.

The green mineral in these sandstones may be described, therefore, as a *mixed-layer hydromica.* Considerable variation exists within the hydromicas, and distinction between such varieties is conveniently made by specifying the types of layers present. Thus the mineral examined is either mixed layer illite-vermiculite, or mixed layer illite—(Ca) montmorillonite, and contains about 80 per cent. illite. It is distinct from both hydrobiotite and hydromuscovite. Hydrobiotite is a mixed layer trioctahedral mica-vermiculite (Gruner, 1934), whereas the Styx Coalfield mineral is predominantly dioctahedral, and has a refractive index lower than those recorded for hydrobiotite. Hydromuscovite is not a mixed layer mineral, and is intermediate in composition and properties between muscovite and dioctahedral illite.

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(Sgd.) FRANK L. STILLWELL.

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº *NS8/1948 STYX*

Location: *BOWMAN. ABOUT 171° 34.6 CH FROM No 3 STATE MINE. NB Disposition of strata. From 0°-5° Dip.*

Inclination & Direction of Hole: *VERTICAL*

Drill: *SULLIVAN N No1* **Size of Core:** *NX*

Drilling Period: *24-2-48* **to** *24-6-48*

Drill Foreman: *T O Lewis*

Logged by: *S R L Shepherd, District Geologist, & J D Lang, Geol*

Plotted by: *J S Douglas*

Depth	Section	Description
0		Decomposed surface shales & sandstones
62' 6"		Ss
		Interbedded ss & sh
65'		Fine gy sh, w coal streaks
70'3" 70'		Dirty coal 3"
73'		Finely laminated dk gy sh, hor
78'		Finely lam dk gy sh, w thin alternating flat ss bands
81 6"		Interlam of ss & sh, ss predominates; lenticular
85'8" 84'6"		Finely lam dk gy sh, w thin alternating flat ss bands
		Clean coal 1'2"
89'3"		Light gy. sh.
91'		Sh; no core
94'7"		Light gy fine ss
96'9" 96'4"		Dark gy. sh. Ss, w sh bands
99'8"		Alternating light gy ss & dk gy sh. Ss predominates
102'11" 101'8"		Light gy fine ss Finely lam sandy sh
105'7"		Fine gy. ss, w occasional sh bands
111'5" 111'		Alternating light gy ss and dk gy sh Ss predominates
		Shaly coal 5"
115'7"		Fine gy ss, w occasional sh bands
117'6"		Fine alternating ss & sh
122' 121'1"		Gy sh w pyrite
126'1"		Dk gy massive sh (no bedding) w coal streaks
		Light gy massive sh, w abundance of pyrite
		Alternating ss & dk sh, irregular & lenticular bands
132' 131		Light gy mudstone.
135		" " ss
142'10"		Fine sh – mudstone – w foss fragments Faulting at 140° indicated
144'1" 143'10"		Fine light gy ss Coal 3"
146'8" 145'7"		Carb sh Fine dk gy ss, showing much slickensiding Med light gy ss
148'10" 148'6" 148'		Coal 4" Carb sh Fine gy ss w carb streaks
150'7½" 150'4"		Coal 3½" Carb sh w coal streaks & slickensiding Gy mass sh
153'2" 152'2"		Alternating ss & sh
153'10"		Fine light gy ss Coal 1"
161'7" 161'8"		Fine light gy ss
171'11"		Fine light gy ss, interlam w sh; ss predominates
177'		Interlam of ss & sh, sh predominates
182'		Coal 5'5"
187'5" 188'11"		Bk carb sh Fine ss w sh bands
190'10"		Dk gy mudstone w foss fragments
192'5"		Gy ss w occasional thin interlaminations of sh
194'4"		Distinctive bed Light gy fine to med ss, w very rare sh bands

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº *NS8/1948 STYX*

Depth	Section	Description
		Continued from previous column
		Distinctive bed Light gy fine to med ss, w very rare sh bands
271'0 271'3"		Coal 3"
		Bk lam carb sh, w thin ss bands
277'8" 277'10"		Coal 11", good quality
		Sh & ss, sm fault planes Coal 5" Hard bk carb sh 4"
282'8" 282'4" 282'1"		Coal 3"
		Dk gy to bk sh, w alternating thin ss bands.
286'10" 286'6"		Coal 4".
		Thin-bedded alternating sh & ss
307'3"		Coal 4'6" and 1 band at 308'4
312'8" 311'7"		Dk gy carb sh
316'		Alternating thin-bedded ss & sh
		Gy fine ss
325'		Thin-bedded alternating light gy ss & dk gy sh Bottom 5" hard ss Slickensiding at 330'-331'
338'8" 338'3"		Irregular coal band 3"
342'8"		Fine sh, no lam
344'4"		Dk carb sh
348'4"		Sh & ss, thinly lam
352'4"		Gy fine ss, w carb streaks
354'8" 354'4"		Black carb mudst Coal 1"
355'10"		Carb sh
		Thin-bedded alternating ss & sh
362'6" 362'6"		Dark gy. carb sh. Black carb sh & coal bands
368'4" 368'3"		Dk fine mudst
370'6" 369'6"		Coal 3'2"
		Fine mass sh.
376'6" 376'6"		Alternating fine ss & sh
378'6"		Black carb sh, slickensided Light gy mass sh, slickensided
383' 382'		No core, fault
384'		Fine gy sh, slickensided
		Carb sh., slickensided fine gy sh
		Fine gy ss, w thin sh bands
398'		Gy med ss
402'		Dk gy sh
404'6"		Carb sh w coaly streaks
409'		Gy med ss
416'6" 415'6"		Coal 1'0"
419'5"		Carb sh w coaly bands
421'2"		Coal 1'9", good quality
424'		Foss dk gy sh
428'		Interlam of ss & sh
428'		Black sh w coaly streaks
430'2" 430'		Black sh Coal 2"
		Black sh w coaly streaks; 6" carb sh at 432
435'10" 435'		Coal 10", good quality
		Dk gy foss. sh
447'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº *NS8/1948 STYX*

Depth	Section	Description
		Continued from previous column
		Ss, w sh streaks
455'		
456'		Gy med ss
		Gy shale; fragmentary core
458'5" 459'		Coal 5"
464'		Foss lif sh, bk, w sandy bands & occasional carb streaks
		Med to coarse light gy ss
482'		Gy sh; fragmentary core
490'		Dk gy sh & ss, w carb streaks
498'7" 495'6"		Coal 8", good quality
		Bk foss sh, w ss streaks
503'10"		
		... gy ss
527'		
530'		Interlam of ss & sh
533'7" 532'9"		Shale, first 3" coaly Coal 10", good quality
535'7"		Foss lif sh, w occasional carb streaks
537'7"		Fine ss, w numerous sh streaks
		Fine to med sm light gy ss w occasional sh streaks.
546'4"		
		Sh, with occasional ss bands
620'6" 620'6"		Prominent green ss
		Med to coarse light gy ss
635'		
638'8"		Ss w numerous intermittations of sh
		Gy sandy sh
643' 642'6"		Fine gy ss Coarse ss Gy sandy sh
645'		Fine gy ss
649'		Gy sh
652'		Light gy med to coarse ss w occasional sh bands
660'		

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S.9/1948 STYX

Location: Bowman. About 168° 347 ch. from No 3 State Mine
Inclination & Direction of Hole: Vertical
Drill: Sullivan N No1 **Size of Core:** NX
Drilling Period: 2-7-48 to 2-10-48
Drill Foreman: T.O Lewis
Logged by: S.R.L Shepherd Dep. Govt and J.D Fox, Geologist
Plotted by: J.S Douglas

Depth	Section	Description
0		Surface gravel, sand, clay & decomp ss
78		Coarse gy ss, containing pyrite
100 1"		Coal 1" Gy foss sh
100 5"		Coarse gy ss, w 1" nodule of coal at bottom
108 6"		Gy sandy sh
107 2"		Gy med ss, w occasional sh streaks
110 6"		Gy sh w sandy streaks
116"		Coarse gy ss, w occasional streaks of coal & sh
121' 10"		Gy sandy sh
125 6"		Gy sh
130'6"		Gy sh w sandy streaks Coal 8"
132'6"		Gy sh
133'2"		Gy ss & sh, Carry sandy sh
136'6"		Ss
136'		Gy sh, stickensided
138'6"		Very fine ss, w sh streaks
138'		
140'6"		Coarse gy ss
145'6"		Carb sh
147'6"		Coarse gy ss
169'		Coarse gy ss, w sh bands
171'		Fine gy ss
177'		Dk gy sh Coal 10"
176'6"		Dk gy foss sh
178		Greenish-gy med ss, w sh streaks
181'		Dk gy sh, w sandy streaks
185'		Coal 2'0"
189'		Dk gy fossilif sh; slickensided
191'		Very fine dk gy ss
192'3"		Light gy med ss
195'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S.9/1948 STYX

Depth	Section	Description
		Continued from previous column
220		Coarse gy ss, w carb partings
224		Fine dk gy ss, w sh streaks & carb partings
226 4"		Dk gy shale; 2" carb band at 228'
229		Very fine dk gy ss
23		Dk gy sandy sh, w ss streaks
.38		Very fine gy ss, w sh streaks
.43		Med to coarse light gy ss
272'9" 271'9"		Coarse grit
276'3" 275'11"		Dk gy foss sh
280 5"		Coal w 4" sh band at 276'3"
284 6" 285 2"		Light gy ss, w sh streaks & carb partings
292		Sh w coaly streaks
		Dk gy fossilif sh, w sandy & carb bands Slickensiding
		Fine gy ss
		Thin interlam of alternating gy ss & dk gy sh
		Light gy med to coarse ss
304 10"		Thin interlam of ss & dk gy sh
309 6" 309 7" 314 4"		Coal 17" Dk gy sh
3.0 6" 3.9 5" 3.2 3" 3.3"		Dk gy fossilif sh, w coaly streaks
		Coal 5'1", w 1" sh band at 3'8'10"
		Dk carb sh Dk gy sandy sh Thin interlam of ss & sh
		Light gy coarse ss
336 7" 337 11"		Coal 1'9"
341		Fossilif sh w carb streaks
346'		Sandy sh Slickensiding at 342'
		Light gy med ss
367 8"		Fine ss w sh streaks. Strong slickensiding at 371'
373'8" 373'1"		Coal 7" Foss dk gy sh
377 376		Interlam of ss & sh
382'		Gy ss w sh streaks
385 6" 384 9" 386 3"		Dk gy sh
388 8"		Coal 10", good qual; Foss dk gy sh
390		Gy ss w thin interlam of sh
394' 394 8" 3 3"		Coal 14", good qual; some pyrite & calcite
		Dk gy foss sh
		Coal 3" Dk gy foss carb sh
		Fossilif sh, w very occasional ss bands
413 6"		Light gy med ss
415 7"		Coal 2'9"
419'5" 418 4"		Carb sh 1"
421 6"		Coal 2'1"
428'		Dk gy foss sh
431 9"		Interlam of ss & sh.
438 9"		Light gy med ss

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S.9/1948 STYX

Depth	Section	Description
		Continued from previous column
448		Interlam of ss & sh
455		Gr ss, w sh streaks
457'3" 456 6" 456 11" 458'5"		Interlam of ss & sh Dk gy sh Coal 4" Carb sh
461'		Very fine gy ss, w sh streaks
465'		Dk gy foss sh
467'9"		Interlam of ss & sh
472'		Ss w sh streaks
475 6" 474 6"		Dk gy sh
477'		Coal 10" good qual
479'6"		Dk gy foss sh
		Interlam of ss & sh
486 5" 486' 485 6" 487'2"		Fine ss w sh streaks 3" carb sh. at 484'5"
490 4"		Coaly sh Dk gy sh Coal sh
494'4"		Foss dk gy sh
499 4" 498'4"		Coal 4'0"
		Light gy sh, broken core
		Very fine ss
		Light to dk grey foss sh, sandy in places
513'7" 512'7"		Ss
517'6" 516 6"		Coal 2'11"
521'5" 523'6" 523 525' 528'		Dk gy sh, w sandy streaks
		Light gy ss, w shaly streaks
		Coaly sh Fine ss Light gy sandy sh
		Fine light gy ss, w sh bands
533'6" 533'3" 535'6" 538'11" 538' 539'8" 541' 540'8" 541'6" 544'6" 546'6"		Dk gy sh; top 9" carb
		Coal 3"
		foss carb dk gy sh
		Very fine gy ss Dk gy sh Coal 9" good qual
		Foss sh Coal 5" slickensided to 541'
		Sh, frag core
		Interlam of ss & sh, slickensided
554'3"		Sh Dip 15°
		Ss with thin interlaminations of sh
564 5" 567'5" 569' 573' 574' 575'9" 578'7" 582' 583'5" 588 3" 589'3" 594'9"		Shale, much slickensiding
		Interlam of ss & sh
		Medium ss
		Sh; slickensided frag core
		Ss with sh streaks
		Foss sh, top 3" coaly
		Medium ss
		Thin interlamination of ss & sh
		Shale
		Dark grey sh
		Coal 1'7"
		Foss sh

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.10/1948 STYX*

Location: *BOWMAN. ABOUT 171°30', 366 CH. FROM No.3 STATE MINE.*
Inclination & Direction of Hole: *VERTICAL*
Drill: *SULLIVAN N.No.1* **Size of Core:** *NX*
Drilling Period: *1-9-48* **to** *20-10-48*
Drill Foreman: *T.O. Lewis*
Logged by: *S.R.L. Shepherd, Dist. Geologist, & J.D. East, Geologist.*
Plotted by: *J.S. Douglas*

Depth	Section	Description
0		Surface clay, gravel & sand
57'		Wh. Sa., w. yellow ferruginous bands
63'6"		Sh
70'6"		Med. Sa
74'		Sandy Sh Sa
78' 77'		Sh with 4" Sa at 88'8", Core 12'0"
97'5"		Fine Sa, w. sh. streaks
101'6"		Med Sa., pyritic
105'2"		Shale
109'8"		Sh with thin interlam of Sa
2'4"		Med to coarse Sa
120'		Dk. foss. sh; coal streaks 120'-120'6"
122'		Med Sa, w occasional sh streaks
137'1"		Thin interlam of Sa & sh. Sh increasing towards base Dip 10°
146'		Coal 2'0".
148'		Sandy sh, w pyrite throughout
154'10" 154'4"		Shale, slickensided
158'10"		Coal 4'0".
160'		Dark gy. sh., w pyrite Sh., w pyrite
162'		Sandy sh
166'		Medium to coarse gy Sa, very occasional carb partings

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.10/1948 STYX*

Depth	Section	Description
Continued from previous column		
224'		Med to coarse gy Sa, w irregular sh inclusions
248'		Shale Coal 3". Bk foss. sh
25' 250'10" 252'1"		Dk gy sh, w thin interlams of Sa Dip 10°
260'6" 259'6"		Coal 1'0", w sh. bands
262'2"		Dk. gy sh
264'5"		Coal 2'3", good qual', 3" sh at 263'8"
268'1" 268'4"		Foss. sh. Coal 7". Dk foss sh
273'		Thin interlam of Sa & sh Dip 9°
280'		Shale w occasional sandy streaks Dip 10°
288'4"		Coal 3'1" w small amounts of pyrite 3" sh band at 290'10". Sh w coal streaks. Coal 4", fragmentary core
292'9" 292'5" 29		Foss. shale; core 1'0".
299'		Interlam of Sa & sh
304'1"		Sa w. sh bands; partly green
3[illegible]		Interlam of Sa & sh, green min in Sa Dip 5°
321' 326'6"		Med Sa
335		Shale, some slickensiding 1" dirty coal at 328'
338'		Thin interlam of sandstone & sh. Dip 10°.
345'4" 345	344'4"	Fine Sa w sh streaks, considerable slickensiding w local folding Coal bands Coal 8". Shale
348'6"		Fine Sa w sh streaks
352'2"		Thin interlam of Sa & sh. Dip 10°.
356'2" 355'2"		Coal 3'0", w 1" sh at 354'9" Dk gy foss. sh. w coaly streaks
362'11"		Interlam of Sa & sh
366'3"		Fine Sa w sh streaks
368'10"		Dk gy sh, w coal streaks
373'6"		Gy. Sa w sh streaks; fragmentary slickensided core
378'2" 375'5" 377'8" 377'2"		Shale, slickensided Coal 6" Coal 9" Carb sh slickensided
380'6"		Fossilif. sh, w very occasional coaly streaks
388'		Fine Sa w sh bands
394'8" 393'8"	392'3" 393'5"	Sh w fine Sa bands Foss. sh. Coal 6" Coaly sh
397'5"		Fine Sa w occasional sh streaks
401'5" 403'		Shale, slickensided fragmentary core Very fine dense Sa, slickensided.
406'5" 406'1" 407'3" 408'3" 408'11"		Dk gy foss. sh Coal 6" Foss sh, coaly streaks 406'-406'5" Interlam of Sa & sh Fine Sa
415'2"		Shale w a coaly band.
426'6"		Shale, w occasional Sa streaks Poor core recovery 3' coal band at 423'; slickensiding 425'6"-426'6".
436'10" 432'1"		Fine Sa w thin sh streaks, occasional slickensides Foss. sh Fine Sa
438'		Shale; fragmentary core; considerable slickensiding

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.10/1948 STYX*

Depth	Section	Description
Continued from previous column		
441'3" 449'8"		Fine Sa
		Med Sa
484		Shaly Sa
488'		Med Sa
499		Med Sa, w irregular sh inclusions & streaks
506		Med Sa
515		Med Sa, w irregular sh inclusions
523		Shaly Sa.
526		Foss. sh
[illegible]		Very fine Sa w sh bands.
[illegible]		Med Sa
540'		Sa w sh streaks & bands.
547'		Sh
552' 554'		Fine Sa, containing green mineral.
56		Sh w occasional sandy bands.
[illegible]		Sh; no core recovery

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº NS 11/1948 STYX

(0 380 as shown, rebored as NS22, 2'N from NS11 Oct 1951)

Location: BOWMAN. ABOUT 168°30' 370 CH FROM No 3 STATE MINE

Inclination & Direction of Hole: VERTICAL

Drill: SULLIVAN N No 2. EOO A Size of Core: NX

Drilling Period: 4-10-51 to 30-10-51 / 26-8-45 to 17-12-48

Drill Foreman: T.O. Lewis (O.L. Evans)

Logged by: S.R.L. Shepherd & J.D. East

Plotted by: J.S. Douglas

Depth	Section	Description
0		
		No core Surface soil
30'		
		Med-coarse grey sa Green min throughout similar top sa in NS19
58'		
		Sa with numerous thin sh bands
70'8"		Sa & sh
75'		Sh
76'10"		Med-coarse sa
79'7"		Sh with sa bands
87'9" 88'3"		Coal
		Grey sh
94'		Sa & sh bands
96'		Sa & sh bands
100'		Interlaminated sa & sh
07'		
		Med grey sa
117'		Thin interlamination sa & sh
120'8" 120'10" 122		Coal Fine grey sa Dark grey sh
127'		
		Thin interlamination sa & sh. Dip 5° (sa predominating at top).
142' 141' 142'8" 144'3" 146'1		Grey sh Sa & sh Dip 5° Dark grey sh Coal Dark sh with sa bands
151'		
		Fine-grained grey sa with odd sh bands.
160' 159' 161' 163' 165' 165'6" 168'6"		Thin interlamination sa & sh Light grey sh Dk grey sh Thin interlamination sa & sh Sh Light grey fine sa
		Shale (light grey fossil fragments)
179' 178' 182' 183'6" 186'		Fine grey sa Grey sh (fossil fragments). F.-med grained grey sa Light grey sh (fossil fragments)
		Light grey med-coarse sa (v coarse 201'-203'6")

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº NS 11/1948 STYX

Depth	Section	Description
Continued from previous column		
		Light grey med-coarse sa (v coarse 201'-203'6")
248'6" 250'6"		Dark grey sh with coal streaks Light grey fine sa with sh bands
255'		
		Thin interlamination sa & sh Dip 5° (sa predominating at top). Coal
261'8" 263'4"		Sh with sa band 268'6"-269'
269'10"		Coal.
272'10"		Dark grey sh (core broken)
275' 277'		Fine grey sa with odd sh bands
		Med-coarse grey sa
292' 290'6" 293'3"		Coal Med grey sa . Dark grey fossil sh.
298'4" 300' 301'		Grey sandy sh (fossil) Dip 3° Interlaminated sa & sh.
		Light grey fine-med sa with odd sh bands (315'-318' alternating sa & sh)
321' 320.5" 321'7"		Coal Thin interlamination sa & sh
		Thin interlamination sa & sh
329' 331' 333'		Grey sa with bands of sh Thin interlamination sa & sh
338'7" 340'4"		Dark grey sh with odd bands sa Dip 5° (fossil & coal streak near base). Coal.
		Grey sh (fossil) odd coal streaks
348'6"		
		Thin interlamination sa & sh Dip 3°.
361'3" 364' 366'8" 368.5" 370'5"		Fine-med light grey sa. Coal. Dark sh-(fossil fragments) Coal
374'11"		Dark grey sh with thin bands sa.
381' 380'		Med grey sa with odd sh bands.
		Thin interlamination sa & sh
390'		
		Sa with numerous sh streaks
402'		
		Sh with occasional sandy bands Dip 5° (3" coaly sh at 407'; 3" coaly sh at 411'6")
45'		
		Interlamination of sa & sh
423'		
		Sa with sh streaks
428' 428'6" 430'		Sh Very fine sa Foss sh with occasional coal streaks
432'		Interlamination of sa & sh (sa predominating)
439'		
		Coal 4'0" (bottom 3" dirty, otherwise good).
443' 446' 445		Foss sh Fine v fine sa

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S 11/1948 STYX

Depth	Section	Description
Continued from previous column.		
447'3"		Coal w shaly bands 1'3"
449'8" 451'		Foss sh Coal 1'3" Coaly sh
452'		
		Fine sa w sh streaks
456' 456' 457'6"		Coal 9" frag core Carb sh, frag core
460'		Dk grey sh
		Fine sa w sh bands.
465' 464'		Foss sh Coal & coaly sh Foss sh
467' 466'		Coaly sh Indurated sh.
468' 469		Black sh, w coal streaks Coaly sh Coal 6"
472' 471'6" 471'		
		Foss sh, w 1" coal at 473'
478'		
480'		Very fine sa, w sh streaks
482		Foss sh, slickensided Dip 5°.
485'		Sa w sh bands
		Dk sh
492'		
495' 496'		Coal 2'0" good qual Foss sh
497'6" 497		Interlam of sa & sh Coal 6"
499		Fine sa
503		Foss sh
		Sa w sh streaks
56'		
		Shale, w sa bands, slickensided
52.		Sa
525		Ferruginous sh
527		Sa & sh
528.6" 530'		Coaly sh, very frag core
		Interlam of sa & sh
535'6" 535' 534'6"		Coal 6" frag core Foss sh
538'		Sa
		Sh w sandy bands
552		
		Sa, w sh bands
563'6" 562'6"		Sh w coal streaks
565'6"		Interlam of sa & sh
567'6"		Shale with 2" coal at 566. Slickensided
		Very fine sa
572		
		Sa w sh streaks
580'		
		Coarse sa
605'		
		Foss sh
609		
		Interlam of sa & sh, sa predominating
69		
		Med sa, w sh streaks
624' 626		Interlam of sa & sh
		Sh Dip from hor to 5° from 605' to 680
657		
659		Very fine sa
		Sh, w occasional sa bands
673'		
		Very fine green sa
678' 677' 680'		Shale Sandy sh

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.11/1948 STYX*

Depth	Section	Description
		Continued from previous column :
682'		Green Ss
685'		Ss.
		Sh w occasional sandy bands
692'		Very fine Ss
696'		Sandy sh
698'		Fine gy Ss
701'		Fine Ss w sh bands
708'		Fine gy Ss, w sh streaks
712'		Shale
718'6"		Fine Ss w foss sh streaks.
724' 723'		Med & coarse Ss
		Fine Ss, w occasional foss sh streaks
728'		Fine Ss, w numerous sh streaks.
734'		Interlam of Ss & sh
737'		Med Ss
739'		Fine Ss, w irregular sh streaks.
741'		Ss, w sh streaks. (Core 1'3" fragmentary).
754'		Fine Ss, w numerous streaks of foss sh Dip 4°.
771'		Sh w Ss streaks
776'		Fine Ss w sh streaks
790'		Light gy med Ss
800'		Med Ss w thin sh streaks
808'		Fine Ss w dk gy sh streaks.
820'		Coarse wh Ss
824'		Dark sandy sh Dip 5°.
828'		Fine Ss
833' 834'		Foss sh
		Fine Ss w sh bands.
844'		Dk foss sandy sh & sh Dip 5°.
862'		Med Ss w occasional sh streaks
883'		Shale. Dip 5°
899'		Fine Ss, w sh bands.
906' 907'6" 908'6"		Shaly Ss Sandy sh
		Very fine Ss, w sh streaks.

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.11/1948 STYX*

Depth	Section	Description
		Continued from previous column :
919' 921'		Sandy sh
		Fine Ss
940'		Shale with occasional sandy streaks
955'		Sandy sh
960'		Shale.
967'		Sandy sh
972'		Fine Ss w sh bands
976'		Fine Ss. Dirty coal 5".
978'8" 978'5" 980'8"		foss fine Ss
		foss shale :- Coaly streaks 980'8"-981'2", Coal 987'6"-987'11", carb streaks at 990', carb sh. 991'6"-992'.
992'		Coal 8'0" (core fragmentary). Pyrites at 995'6"
1000'		Dk fine Ss, w coal streaks & sh bands.
1003'		Shaly Ss w sm pebbles.
1006'		Pebble congl. w Ss bands.
1042'		Med Ss
1048'		BASE OF COAL MEASURES
		Very dense sedimentary rock containing abundant sm. reddish grains, some more distinctly sandy bands.
1094'		Very dark gy dense Ss. Slickensiding common.
1129'		Light gy clastic rock. Almost certainly a tuff. Green highly weathered mineral prominent.
1143'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.11/1948 STYX*

Depth	Section	Description
		Continued from previous column :
1200'		Very dk gy dense Ss. Occasional streaks of pyrites. Several slickensided calcite facings.

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº N.S.12/1948 STYX

Location: BOWMAN. ABOUT 169°55' 326 CH FROM NO 3 STATE MINE

Inclination & Direction of Hole: VERTICAL

Drill: SULLIVAN N No.1 **Size of Core:** NX

Drilling Period: 27:10:48 to 22:3:49

Drill Foreman: T O Lewis

Logged by: J D East, Geolog st.

Plotted by: J S Douglas

Depth	Section	Description
0		Surface clay, gravel & sand
62' 63'6"		Ferruginous sa w sh bands
		Med sa
67'6"		No core, sh ?
69'6" 71		Shale
72'6" 75'		fine sa w sh streaks
		Sandy sh
		No core, sh
92'		Shaly sa
95		Shale, w sandy streaks
97'1" 97'8"		very fine sa Coal 4"
99 100'10"		Foss sh
		Med sa
108'		Med sa w thin sh streaks, sub-hor
2		Fine sa w sh bands
5'6"		Shaly sa
117'9" 119'1"		Dk gy sh. Coal 8" Foss sh w coal streaks
124'5"		Very fine sa, w sh streaks
		Shaly coal 5"
		Shale, w very fine sandy bands
131'		Thin interlam. of sa & sh
34'6"		Fine sa
139'		Sandy sh
141'		Thin interlam of sa & sh, sub-hor
143'8"		Fine sa w sh streaks
147'6" 149'2" 150'8" 152'6" 152'2"		Foss sh. Coal 1'6" Dirty coal 4" Foss sh Shale w coal streaks
156'		Fine & med sa w sh streaks
163		Interlam. of sa & sh
165'8" 167'9"		Coal 11", w 1" band at 165'2" Shale
170'8" 172'5" 174'2"		Coal 20". Foss sh w coaly streaks
177'4"		Sandy sh
181' 180'4" 181'8" 184'		Coal 3'0" Foss sh. Coaly sh, slickensided. Fine sa w irregular sh streaks
		Med sa w very occasional sh streaks
200'		Fine sa w sh bands
204'1"		Dk interlam of sa & sh Dip less than 5°
207'10" 209'1"		Coal 9" Coaly st

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº N.S.12/1948 STYX

Depth	Section	Description
Continued from previous column :		
211' 215'8"		Shale Coal 4'8"
222'		Foss sh
		Med & coarse sa
291'9" 295' 294'1"		Shale, n coaly streaks, slickensiding Foss sh
301'		Very thin interlam of sa & sh Dip 4°
303'3" 305'6"		Very fine sa Dk gy shaly sa
308'8" 310'5"		Dk gy foss. sh & sandy sh, w occasional coal streaks
312'9"		Fine sa Foss sh Coal 1'0" w 3" sh at 311'6"
3'8"6		Fossilif sh, w occasional carb streaks
325'		Thin interlam of sa & sh
330'9" 330'		Shale, w thin sa streaks
335'10" 335'		Sa w sh streaks Coal 4'3" Carb sh
341'6"		Very thin interlam of sa & sh Dip 4°
350'		fine sa w occasional sh streaks
		Thin interlam of sa & sh
363' 365' 367'		Shale, w occasional carb streaks Very fine sa, w sh streaks
369'10"		Fossilif sh, w carb streaks at 368'.
375'9"		Thin interlam of sa & sh Dip 4°
381'		Black foss sh.
385'		Very fine sa, w thin sh streaks
394'6" 397'2" 397'		Dk fossilif sh; much slickensiding Coal 2'6"; core 1'6". Carb sh
401'6" 404'		Med sa w occasional sh streaks Dk gy sh; slickensided
407'		Light gy sh; slickensided
412'		Foss. sh & sandy sh.
416'1" 415'8"		Med sa Highly slickensided coaly sh.
423'2" 422'8"		Med sa w sh bands
425'1" 425'8"		Coaly sh Dk shale, w occasional coaly streaks & much slickensiding
430'		Shaly coal 3". Black sh
436'6"		Shale, very much disturbed & fractured core
		very fragmentary core
		Bk highly slickensided shale, w 2" coal at 438', 2" coal at 440'6";

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº N.S.12/1948 STYX

Depth	Section	Description
Continued from previous column :		
441'6"		Thin interlam of sa & sh, fractured core.
455'		Bk shale, fractured core.
458'		Sandy sh; slickensided
460'6" 462'		Fine sa, slickensided, highly slickensided fragmentary shale, w coaly streaks
465' 464'		Interlam. of sa & sh Bk shale; slicken frag. core. Coal 5"
467'8" 467'6" 467'		Shale; slickensided, v frag core.
471' 470'		" " practically powder
479'		Interlam of sa & sh; v. frag core
485'		Med sa, w sh bands; core partly frag
488'6"		Sa w streaks of sh; core frag; slickensided
491'10" 490'7"		Sh, v fragmentary core; much slickensiding Coal 13".
		Shale; v frag core; much slickensiding throughout.
505' 507' 508'6" 509'6"		Hard sa Sh, highly slickensided frag. core. Fine sa
		Sh; v. frag core 6'0".
521'		Fine sa w. sh. bands; largely frag core, much slick.
533' 532' 533'2"		Sh; v frag. core; highly slickensided. Sa, w occasional sh bands; frag core.
		Fine-med sa.
564'11" 564'3"		Carb sh
570'		Very thin interlam. of sa & sh. Dip 4°.
572'6"		Sa, w numerous sh bands.
576'6"		Sa, w irregular bands of sh. Dip 6°.
		Dk gy sh
591'3" 593'6"		Fine sa, slightly green
		Dk gy sh w 3" green sa band at 614'6", slickensiding at 600' & 606'.
617'2" 621'		Fine sa, w thin sh & carb streaks
626'10"		Interlam. of sa & sh. Dip 12°.
		Fine sa, w abundant tiny irregular inclusions of sh.
639'7"		Fine sa, becoming shaly at base; slickensiding & calcite facings
645'7" 648'		Sandy sh
		Sh, . w occasional sandy sh bands
656'6" 657'4" 660'		Fine sa, slightly shaly. Med. sa
		Sandy sh, w thin sa streaks. Dip 8°.
667'1"		Med – coarse sa
674'		Interlam. of sa & sh. Dip 10°–12°.
680'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.12/1948 STYX*

Depth	Section	Description

Continued from previous column :

692 — *Fine sa w occasional sh bands*

Fine sa w fairly numerous sh streaks Dip 10°

Fine sa w only rare sh streaks

744' 4" — *Fine sa w numerous sh streaks* — *Med sa*

Very fine somewhat shaly sa. Dip 10°

750' 6" / 752' — *Med sa*

Dk gy. sandy sh, w sa bands Dip 10°

772' — *Wh med-coarse sa, w very occasional shaly streaks*

785' — *Gy fine sa, w sh streaks*

790 — *Wh fine sa*

793' — *Dk gy shale Dip 10°-15°*

812' — *Very fine dk g.y sa, w sh streaks Dip 10°*

824' — *Shale, w sandy streaks Dip 5°*

835' — *Fine sa w sandy sh bands*

844' 2" — **BASE OF COAL MEASURES**

Greenish sh, w tiny red inclusions

852' / 853' 6" — *Gy. sa*

Gr sh, w tiny red inclusions, & sa bands

860 — *Gy sa, w occasional sh bands*

887 — *Gr med sa, w tiny red inclusions*

903 — *Gr fine sa*

908 — *Gr & purple sh*

912' — Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.12/1948 STYX*

Depth	Section	Description

Continued from previous column :

Cy & gr sa, w practically complete absense of sh bands 1' very sm pebble congl at 923'. 1' congl sa at 989' Dip 40° at 977'; 45° at 1004'; 50° at 1017'. These dip angles are not beyond dispute and so should be treated with some reservation

1017' 6" — Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.13/1949 STYX*

Location: *BOWMAN ABOUT 167° 330 CH FROM No.3 STATE MINE*

Inclination & Direction of Hole: *VERTICAL*

Drill: *SULLIVAN 200A* **Size of Core:** *NX*

Drilling Period: *11.1.49* **to** *18.6.49*

Drill Foreman: *T.O. Lewis*

Logged by: *S.R.L. Shepherd, Dist. Geol & J.D. East, Geologist*

Plotted by: *J.S. Douglas*

Depth	Section	Description

Surface sand, clay & gravel

59' 9" — *Yel. fine-med. ferruginous sa*

72' — *Light gy fine-med. sa, w very occasional sh streaks*

Light gy med-coarse sa, w very occasional sh streaks

134' — *Coarse sa, w irregular sh inclusions in bottom 6".*

138' — *Shale, w 6" shaly coal at 139'9".*

141' — *Sandy sh*

145' 6" / 144' 7" — *Shale, w 1" coal at 144'7".*

Fine sa, somewhat shaly, ½" coal at 150'6". ½" coal at 152'7" ½ coal at 152'10"

154' — *Coarse sa*

158' 10" — *Sandy sh w sa bands*

164 — *Shale*

167' 3" — *Fine sa, w numerous sh bands. Dip 5°*

169' 9" — *Shale, w sa bands. Shaly coal 6".*

172' 6" / 172' — *Sandy sh*

179' — *Fine sa*

180' / 182' — *Shale*

181' — *Fine sa*

Shale, w 2" coal at 187'

188' — *Fine sa w sh bands*

190' 6" — *Sandy sh & sh*

193' 9" — *Foss sh, w 3" coal at 193'9". Shaly streaks at 194' and 3" shaly streaks at 195'6"*

196' — *Med sa*

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *NS13/1949 STYX*

Depth	Section	Description

Continued from previous column :

212' 215' 216' 218' 219'9" — Interlam of ss & sh. Sandy sh. Fine ss. Dk sh. Coal 1'6", bottom 4" shaly. Fossilif sh Dip 11°

225' 228' — Fine ss

236' — Interlam of ss & sh. Dip 10°

241'7" 242'7" — Med ss. Coal 10". Fossilif sh, w coal streaks, 2" dirty coal at 245'

246' 247' 249' — Shaly coal 10". Foss sh. Fine ss, w occasional sh bands. Core splits longitudinally

260' 261' 262'6" 263'3" — Fossilif sh w sandy bands, and occasional coaly streaks. Fine ss. Coal 8", top 3" dirty. Fossilif sh, w coal streaks.

263'6" 268' — Very fine ss. Fossilif sh; slickensiding at 267'1" coal at 267'5"

273' — Foss sh & sandy sh

276' — Fine ss w sh bands

286'8" — Foss sh & sandy sh

293'1" — Sh & sandy ss w 4" coal at 286'8", 2" coal at 292'6", 5" coaly sh at 292'8"

296'9" 298'9" 302' — Med ss, w 3" foss Lf sh at 296'6". Fine ss. Fossilif sh

Med ss 3" conglomeratic band at 317'

318' 320' — Fine ss, w numerous sh streaks. Thin interlam of ss & sh Dip 8°

324' 325'6" 327' — Bk foss carb sh. Coal 10", frag core. Dark shale; 6" sandy band at 329'6".

333'6" 332'6" — Very fine ss. Coal 1'5".

339' 337'9" — Fossilif sh, frag slickensided core

Med ss; fractured longitudinally

352'2" 354'2" — Coal 2'0". Foss. sh

363'6" 362'6" — Fine ss w sh streaks

Med ss

394'10" 394'4" — Coal 6". Fossilif sh. Dip 11°

399' — Thin interlam of ss & sh

403' 401'10" 404' — Coal 12". Fossilif sh, w carb streaks. Interlam of ss & sh. Coal 9"

407'3" 406'6" — Fossilif sh; slightly carb.

410'5" 410'8" — Coal 7", incl 2" sh band. Fossilif sh, first 6" carb

416'9" 421' — Thin interlam of ss & sh, sh predom. Dip 15°. Calcite band at 620'3".

Shale, w very fine sandy streaks Dip 11°

438'6" 439'4" — Coal 10"; fragmentary core 8".

443'3" — Fossilif sh, w very fine sandy streaks

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *NS13/1949 STYX*

Depth	Section	Description

Continued from previous column :

447'6" — Med ss w irregular sh streaks

450'9" — Interlam of ss & sh, ss predominating Dip 11°

Slightly green fine ss with sh streaks

459'8" 461'10" 465' — Foss sandy sh & sh. Rare coal streaks. Very fine foss ss, w sh streaks

Dk shale. Dip 10°.

468'6" 469'3" 471' — Coal 9", dirty. Bk foss shale, w very thin coaly seams

473'6" — Sandy sh & sh

476'8" — Bk fossilif sh; considerable slickensiding

Thin interlam of ss & sh Dip 18°

482'9" 484' — Sandy sh & sh

488'6" — Bk fossilif sh, w 6" carb sh bands at 486'6" & 487'6". Dip 16°

Thin interlam of ss & sh Dip 18°

495' — Bk fossilif sh, slickensided Dip 16°. First 6" carb, 3" coal at 495'6", 6" coal at 496'6"

501' 505' 506' — Coal 4'0". Foss sh. Fine ss Dip 18°

510' — Dk fossilif sh, slickensiding particularly at 513'

516' — Fine ss

520'3" 521'6" 523' 525' — Coal 10". Bk foss carb sh. Sh frag core, highly slickensided. Fine-med ss

Shale, w 4" coal at 525'6"; slickensided, v frag core

531' — Very fine ss w sh bands; frag core

535'6" — Fine ss w occasional sh streaks

539'6" — Fine-med ss, w numerous irregular sh inclusions

544'6" 545'6" — Shale

Interlam of ss & sh Dip 15°–Dip 11°

552' 555' — Shale

555'4" 557' 558'6" — Med ss, w very thin coaly sh Dip 11°. Dk fossilif sh, w carb streaks. Interlam of ss & sh

562' — Dk fossilif sh

Interlam of ss & sh; ss predominating Dip 10°

568'6" — Fine ss

571'6" — Dk fossilif sh, w 6" coal at 575'6"; slickensiding at 574'

577'6" — Mass med-coarse ss

619' 622' 626' — Sandy sh, frag core. Fine ss

Sh, frag, slickensided core. Bottom 4'0" sandy 6" coal at 629'

642' 641' — Fine ss w slickensided calcite bands

647'6" 646'6" — Foss sh & sandy sh. Fine ss w sh bands

Fine ss w occasional sh streaks

667'8" 670' — Dk gy foss sh

Interlam of ss & sh; ss predom Dip 11°

676' — Fine ss w irregular sh inclusions

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *NS13/1948 STYX*

Depth	Section	Description

Continued from previous column :

684'6" 688' 690' — Sandy sh. Fine ss w irregular sh inclusions. Sandy sh

Shale, w occasional sandy sh bands Dip 5°

714'3" — Very dark gy foss shale, w very occasional ss bands, ss has slight green tinge Dip 11°

737' 741' — Fine ss, w numerous thin sh streaks, & a prominent green mineral

Gy fine-med ss, thin coaly streaks at 753'

756' 755' — Sh w sandy bands. Gy med ss

763' — Very fine ss w sh bands

772' 776' — • • • • • more prominent. Shale Dip 10°.

783' 785' — Very fine ss w sh bands

Fine-med ss Dip 4°

794' 793' — Fine ss w sh bands. Shale, w very fine ss bands

801' 805' — Med ss w sh bands. Shale

816' — Fine ss with sh bands

824' — Sh w ss bands

830' — Fine ss w sh bands

837' — Shale, w ss bands

850' — Ss w sh bands, longitudinal fracturing 859'–865'

865' — Med ss, fracturing 869'–870'

873' — Med ss; core 3'6".

881'3" 880'8" — Ss, no core. Ss, core 4'0"

891' — Ss, no core

896'6" — Fine-med ss, w occasional sh bands, core frag. 896'6"–899'.

904'5" 906'8" 908'8" 910'6" 912' — Shale. Ss w coal streaks. Ss w sh bands. Coarse ss. Fine ss w foss. sh streaks

916'8" 915'8" — No core

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS 13/1949 STYX*

Depth	Section	Description

Continued from previous column

Sheer

946.8' 945.3' Sandy sh
946' Med sa
952.8' 952.3' Fine sa Mudstone

Sh with 5' band sa at 958', 6' band hard sa at 964', from core 960'-962'

962.9'

Very fine sa w sh bands

976.6' 976.6' Shale

Very fine sa

999

Shale

10

Very fine sa, w sh bands

10.9'

Sh w sa bands

1074.3'

Fine sa & thin sh bands

1040.6' Coal 40"
1044.6' 1045.6' Carb sh
1046.9' No core
Fossilif sh, slightly carb

1054'

Coal 90

1063

Fossil sh
1067.6' 1067.9' Coal 6" Coaly sh
1070.5' Fossilif sh w occasional coaly streaks

Conglomerate, fracturing plentiful

1088.8'

NB Dips below 800' are less than 5°

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS14/1949 STYX*

Location: *BOWMAN ABOUT 164°30', 356 CH. FROM NO 3 STATE MINE.*
Inclination & Direction of Hole: *VERTICAL*
Drill: *SULLIVAN N No 2* Size of Core: *NX*
Drilling Period: *29.3.49* to *10.9.49*
Drill Foreman: *T O LEWIS*
Logged by: *S R L Shepherd, Dpt Geolog St, & J D Lang, Geology St*
Plotted by: *J S Douglas*

Depth	Section	Description

Surface sand clay & gravel

90'

Sh, fragmentary core

95'

Fine & med sa

177'4" Shale with 1¼" coal at 178'.
181'5" 181'9" 181'6" Coal 3" Carb sh

Sh, slightly sandy

189
192' Fine sa
Foss sh
196' Med sa
198' Interlam of sa & sh

205' Sh.

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS14/1949 STYX*

Depth	Section	Description

Continued from previous column

209'6" Med sa
213'3" 213'6" 214' Shale Coal 9" Foss sh
218'

Sandy sh & sh Dip 3°

231'

Very fine sa
234' Sandy sh
237'

Med sa

249'

Sa w sh bands
257'4" 257' Coal 4"

Foss shale, frag core

265'
267'

Sa, w sh streaks

Foss shale with sandy streaks, occasional coal streaks at 274

276'
278'6" Fine sa
Foss sh
283'
285' Med sa
288' Sh, slightly sandy
289' 290'6" Foss shale Dip 5° Coal 10"
Med sa

296'

Very fine sa, slaty shale

300'

Foss sh

306'6"

Fine sa w sh bands

317'6"

Foss sh & sandy sh, first 6" carb
334'6" 335'6" Med sa

Foss sh

334'6" No core
336' Sh
339'8" 338'6" Coaly sh
Foss sh
345' Fine sa
346'6" Shale
348'6" Fine sa Coal 3"
356'1" 350'6" Foss shale with 2" coal at 352'11"
355'

Fine sa

372' 371' Sa w sh bands Fine sa
373'6" Interlam of sa & sh
380'6" 380'3" 379'8" Coal 7" Carb sh
Foss sh
384'8" 383'10" Coal 10"
Shale
389'

Gy fine-med sa

400' 399'4" Coal 8" frag core
No core
401'8" Foss sh
401'8" Sa w sh bands
412'8"

Fine-med sa

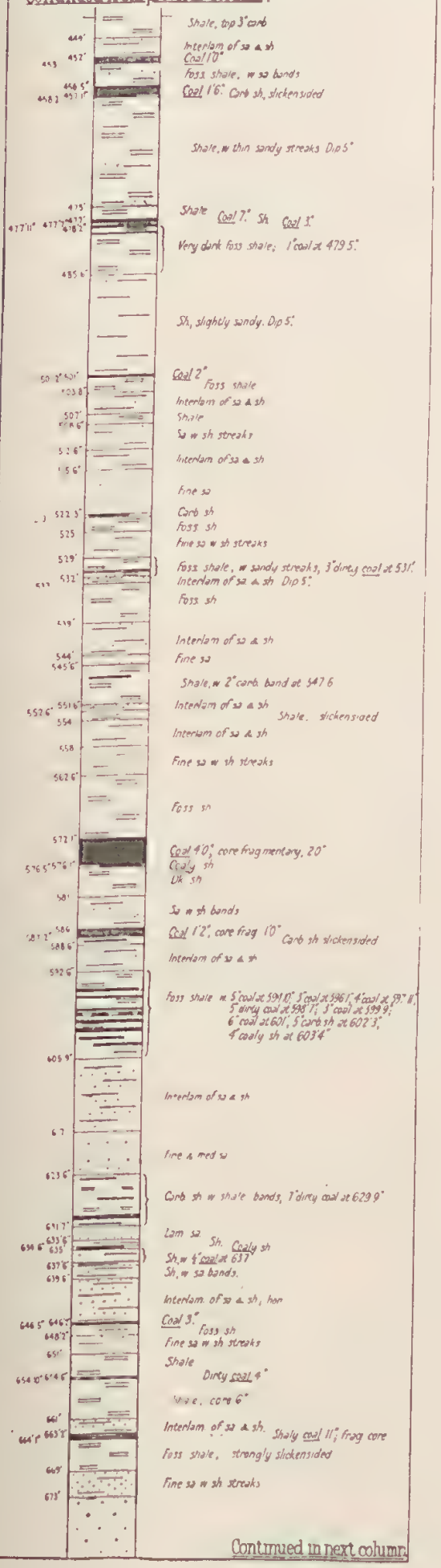
444'9"

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *N.S.14/1949 STYX*

Depth	Section	Description

Continued from previous column :

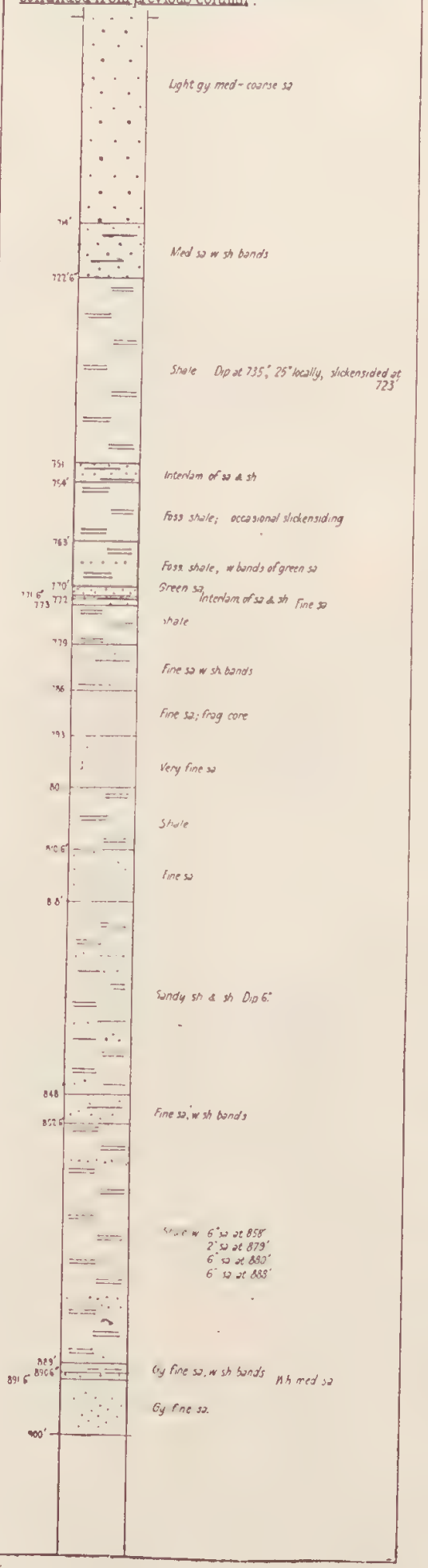

Shale, top 3" carb
Interlam of ss & sh
Coal 10"
Foss shale, w ss bands
Coal 1'6" Carb sh, slickensided
Shale, w thin sandy streaks Dip 5°
Shale Coal 7" Sh Coal 1"
Very dark foss shale; 1" coal at 479 5"
Sh, slightly sandy. Dip 5°
Coal 2" Foss shale
Interlam of ss & sh
Shale
Ss w sh streaks
Interlam of ss & sh
Fine ss
Carb sh
Foss sh
Fine ss w sh streaks
Foss shale, w sandy streaks, 3" dirty coal at 531'
Interlam of ss & sh Dip 5°
Foss sh
Interlam of ss & sh
Fine ss
Shale, w 2" carb band at 547 6
Interlam of ss & sh Shale, slickensided
Interlam of ss & sh
Fine ss w sh streaks
Foss sh
Coal 4'0", core fragmentary, 2'0"
Coaly sh
Dk sh
Ss w sh bands
Coal 1'2", core frag 10" Carb sh slickensided
Interlam of ss & sh
Foss shale w 5" coal at 591 0"; 5" coal at 596 1"; 4" coal at 597 8"; 5" dirty coal at 598 7"; 5" coal at 599 9"; 6" coal at 601'; 5" carb sh at 602 3"; 4" coaly sh at 603 4"
Interlam of ss & sh
Fine & med ss
Carb sh w shale bands, 1" dirty coal at 629 9"
Lam ss Sh. Coaly sh
Sh, w 4" coal at 637
Sh, w ss bands.
Interlam. of ss & sh, hon
Coal 3" Foss sh
Fine ss w sh streaks
Shale
Dirty coal 4"
Shale, core 6"
Interlam of ss & sh. Shaly coal 11"; frag core
Foss shale, strongly slickensided
Fine ss w sh streaks

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *N.S.14/1949 STYX*

Depth	Section	Description

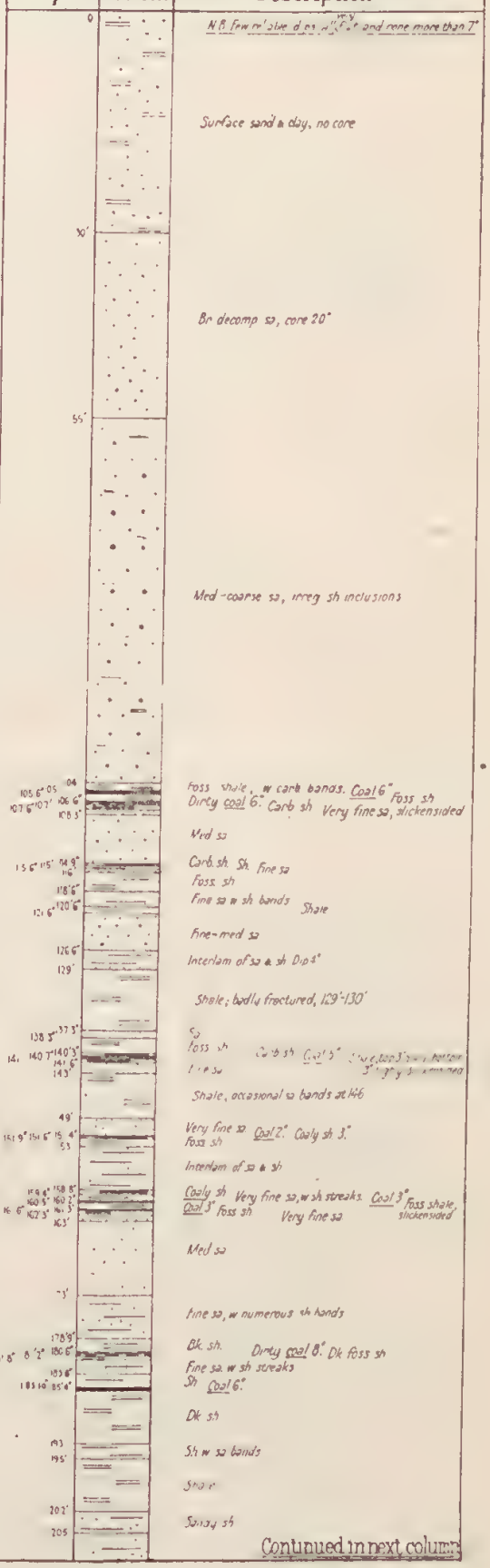
Continued from previous column :


Light gy med-coarse ss
Med ss w sh bands
Shale Dip at 735', 25° locally, slickensided at 723'
Interlam of ss & sh
Foss shale; occasional slickensiding
Foss shale, w bands of green ss
Green ss, Interlam of ss & sh Fine ss
shale
Fine ss w sh bands
Fine ss; frag core
Very fine ss
Shale
Fine ss
Sandy sh & sh Dip 6°
Fine ss, w sh bands
Shale w 6" ss at 858'
2" ss at 879'
6" ss at 880'
6" ss at 888'
Gy fine ss, w sh bands Wh med ss
Gy fine ss.

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *N.S.15/1949 STYX*

Location: *BOWMAN ABOUT 169°45', 307 CH FROM No 3 STATE MINE*
Inclination & Direction of Hole: *VERTICAL*
Drill: *SULLIVAN 200A* Size of Core: *NX*
Drilling Period: *27/6/49* to *24/9/49*
Drill Foreman *T O Lewis*
Logged by: *S.R.L. Shepherd Dist. Geol. & J.D. East, Geologist.*
Plotted by: *J.S. Douglas*

Depth	Section	Description


N.B. few rr' stone d.s. w.v.f.c. and rare more than 7"
Surface sand & clay, no core
Br decomp ss, core 20"
Med-coarse ss, irreg sh inclusions
Foss shale, w carb bands. Coal 6" Foss sh
Dirty coal 6" Carb sh Very fine ss, slickensided
Med ss
Carb sh Sh fine ss
Foss sh
Fine ss w sh bands Shale
Fine-med ss
Interlam of ss & sh Dip 4°
Shale; badly fractured, 129'-130'
Ss
Foss sh Carb sh Coal 3"
Fine ss
Shale, occasional ss bands at 146
Very fine ss Coal 2" Coaly sh 3"
Foss sh
Interlam of ss & sh
Coaly sh Very fine ss, w sh streaks. Coal 3" foss shale,
Coal 3" foss sh Very fine ss slickensided
Med ss
Fine ss, w numerous sh bands
Bk. sh. Dirty coal 8" Dk foss sh
Fine ss w sh streaks
Sh Coal 6"
Dk sh
Sh w ss bands
Shale
Sandy sh

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *NS15/1949 STYX*

Depth	Section	Description

Continued from previous column :

Fine sa w sh bands
Coaly sh; core frag; slickensiding
Coal 10" Shale
Shale, much slickensided

Fine & med sa, w occasional sh bands, fracturing at 229'

Fine sa w numerous sh bands, fracturing at 232'
Coal 3 6", incl 4" sa at 234', 2" sa at 234' 7", 3" sa at 235' 3"
Sh w coal bands, slickensided
Sh, slickensiding 238'-241'.
Foss carb sh Granulated carb sandy sh Coal 4"
Coaly sh Sh, slickensiding 244'-245 6".

Med sa, w sh bands 253'-255'

Interlam sa & sh

Foss shale, slickensided
Fine sa Thin interlam of sa & sh Dip 7°
Dirty coal 1'0", frag core Foss shale, slickensided
Coal 6" foss slightly carb shale, slickensided.
Coaly sh, frag core
Shale, w occasional coal streaks, highly slickensided
Fine sa w sh bands

Med sandstone + irregular sh inclusions at 347' & 351.

Fine sa w sh bands
Sh. Coaly sh. Foss sh
Very fine sa w sh streaks Dirty coal 10"
Foss shale, w 1" coal at 369' 3".
Foss shale. Coal 10".

Foss shale. Dip 5°

Fine sa w sh streaks
Coal 4' 3".
Foss. sh

No core, sh? (Driller).

Thin interlam of sa & sh. Dip 5°.

Foss [illegible], w sandy bands Slickensiding at 424' 425' Dip 45° at 426

Thin interlam of sa & sh. Dip 6°
Foss shale, slickensiding Coal 10".
Thin interlam of sa & sh. Dip 5°.
Coal 9" Carb sh
Dk foss shale, slickensided & fractured
Fine sa

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *NS15/1949 STYX*

Depth	Section	Description

Continued from previous column :

Med sa
Shale
Med sa
Shale
Sandy sh & sh Local dip 12°
Fine sa
Foss shale Dip < 3°
fine foss sa

Shale, frag core Dk shale, w coal streaks
Sh w occasional coal streaks, highly slickensided, frag core
Fine sa containing contorted streaks, slickensided.
Coal 6"
Dk shale, highly slickensided
Coal 6", core partly fragmentary
Sandy sh & sh, slickensided

Thin interlam of sa & sh, sa predominating

Foss shale, w coal streaks at 529'6", 1" coal at 530'6", 1" coal at 533'6", slickensiding at 531', 532', & 533', core frag 536'6" - 538'

Thin interlamination of sa & sh

Coal 4", frag core Foss shale, first 4" carb; hor.
Med sa
Shale
Sandy sh Foss sh
Coal 2'3", good quality
Foss sh
Shaly coal 7", slickensided
Foss shale, w coal 7", 568'3" - 568'10"
Fine sa w sh bands. Coal 6"
Foss shale, w occas! coal streaks
Very fine sa w sh streaks

Med sa

Coal 1'4", good quality Foss shale, slickensided
Sh w sandy streaks

Fine sa w sh streaks

Shale, w green sa streaks at 620'

Very fine sa w sh bands

Shale, w occas! green sa streaks.

Sandy sh Green sa
Med sa
Sa w sh bands
Fine sa w numerous thin sh streaks

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *NS15/1949 STYX*

Depth	Section	Description

Continued from previous column :

Fine sa, w numerous irreg sh inclusions

Fine sa, w sh bands.

Foss shale, w occasional sa bands

Med sa Sandy sh
Coarse sa.
Fine sa w sh streaks
Shale. Dip < 3°.

Med sa

Foss shale, w occas. sandy bands.

Very fine sa w sh bands

Foss sh w sa streaks
Fine sa w sh bands
Shale. Dip 2°.

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº N.S 16/1949 STYX

Location: BOWMAN ABOUT 172°45', 327 CH FROM No. 3 STATE MINE

Inclination & Direction of Hole: VERTICAL

Drill: SULLIVAN N No 2 **Size of Core:** NX

Drilling Period: 3-11-49 to 21-3-50

Drill Foreman: T.O. Lewis

Logged by: S.R.L. Shepherd, Dist. Geologist, & J.D. East, Geologist

Plotted by: J.S. Douglas

Depth	Section	Description
0		Surface sand & gravel, no core
66'		Shaly fine foss. sa.
70'		Fine sa. w sh. bands, core very frag. 2'6".
93'6"		Fine sa. w. sh. streaks.
97'6" 96'6"		Shale, w thin sa. streaks
99'0" 98'3"		Fine sa. Coal 9".
100'6"		Fine sa. w. sh. bands
		Med sa
109' 108'		Coal 1'0". Foss. shale, w ½" coal at 110'3½". Very fine sa, sticken
111' 110'4"		Fine sa. w. sh. streaks.
113'6"		Sandy sh. Fine sa Coal 5". Slickensided coaly sh.
115'2" 115'9" 115'		Coal 9". Coaly sh. No core; ? soot w. small sh. bands
118'9" 117'		Foss. shale Very fine sa. w. sh. bands.
120'6" 120'		
122'		
142' 141'		Med sa
146'9" 146'		Fine sa. w. sh. bands
		" " " thin sh. streaks
		Shale.
		Coal 5'0"
154'7" 153'9" 153'6"		Shale Sa Coal 10". Carb sh.
155'5"		Foss. shale, w 6" sa at 156'6"
159'5"		Sa, frag core 1'0".
164'9"		
		Med.-coarse sa.
206'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº N.S 16/1949 STYX

Depth	Section	Description

Continued from previous column:

		Med sa, w thin bands & irreg inclusions of sh
252'10" 251'6"		Coal 1'4".
256'5"		Shale, w very fine sandy streaks. Dips 10° & less
258'2"		Coal 1'9".
		Shale, w very thin sandy streaks, only streaks in first 6". Dip varies from 6° to max of 14°
271'		
		Bk shale, w 6 l'bands of coal
283'		Foss sh
286'6"		Fine sa, w. sh streaks.
294'		
		Foss. shale, w thin sa streaks. Dip 15°
305'6"		Fine sa; fracturing at 308".
309'		Shale, slickensiding at 309'6".
311'		Shale, w. sandy bands. Coal 8".
313'6" 312'10"		Foss. sh
315'6"		Sandy sh; fract.
317'6"		Foss. shale, slickensiding; coal streaks at 321'. Dip 15
322'		
		Shale, very fract. w slickensided core 2'0".
330' 329'		Coal 1'0". Foss. shale, slickensided.
331'		
		Fine sa., w occasional sh streaks; slickensiding prom.
339'6"		
342'1" 341'7"		Bk. shale, w coal streaks; core partly frag Coaly sh.
345'8" 345'2"		Coal 3'1" incl. 1" sh band. Coaly sh.
350'		Fine sa., w thin sh streaks; some slickensiding
		Slickensided shale, w 8" coal 351'8"-352'4"; 3" coal 354'6"-354'9"; 4 coal 356'2"-356'6"; 10" coaly sh 356'6"-357'6".
359'6" 359'		Coaly sh. Coal 2'0".
361'6"		No core.
366'6"		
		Shale; highly slickensided, very frag core.
373'8" 372'6"		Hard ferruginous sh. No core
374'2"		
		Sh & sandy sh., w sa bands, very frag slickensided core; coaly band at 385'.
390'8"		
392'6" 392'		Coal 1'4". Sh
395'6" 395'		Bk. sh., frag. slickensided core. Coal 6".
397'2"		Bk. sh., w coal streaks. Thin interlam. of sa. & sh.; sub.-hor
398'11"		Coal 1'4".
400'3"		Bk. foss. sh.
402'6"		
		Fine & med. sa.
433'3" 432'9"		Dk. foss. sh. Shaly coal 8".
435'11"		Foss. sh., w thin sandy streaks. Dip 6°.
436'		Fine to med. sa.
440'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION

BORE Nº N.S 16/1949 STYX

Depth	Section	Description

Continued from previous column:

		Med sa, w ferrug sh bands
450'6"		
		Sh, w 6" band sandy sh with green particles at 461'; 8" hard ferrug. band at 478'; slickensiding 477'-484'. Dip 8° at 464.
484'		
		Sandy sh & sh, containing very sparsely scattered green particles.
491' 490'6"		Green sa
493'		Sa w sh bands
		Fine sa w abundant irreg sh inclusions Dip 9°.
505'9"		
		Fine sa
510'		
		Fine sa. w. sh. bands Dip 9°.
517'3"		
		Foss sh
522'		
524'6"		Med sa
		Sh. w sandy sh, w 4" ferrug band at 528', w 5' sa band at 529'. Dip 9°
530'9"		
		Med sa w sh streaks
538'9"		
		Interlam of sa & sh; sa predom. Dip 7°.
548'		
		Fine w
554'		
		Fine sa w sh bands Dip 8°
576'9"		
		Fine & med sa
598'6"		
		Coarse sa
602'		Sh
604'		Fine sa. w. sh. bands.
607'3"		
		Sh w thin bands of fine sa. Dip 3°.
615'9" 614'8"		Fine sa w. sh. bands
		Fine & med sa., v. light gy., occasional v thin carb streaks.
626'3" 625'9"		Sh.
		Fine gy sa, w. sh. bands.
631'9"		
		Fine & med sa, v light gy; occas v thin carb streaks.
645'9"		
		Sh, w occas. sandy sh. bands; heavy ferrug. bands, 5" at 647'; 6" at 650'3"; 9" at 654'9". Dips 6° at 645; 8° at 652; sub.-hor at 658".
660'		
		Very fine dk gy sa. of shaly nature.
677'		
679'		Sh.
		Fine sa
678'		Very fine sa. w. sh. bands..
681'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.16/1949 STYX*

Depth	Section	Description
Continued from previous column :		
690'6" 699'		Very fine sa of shaly nature
		Sh
		Fine sa w sh bands 698'-700'
701'		
		Sh, w very thin sa bands Dip 6°
709'		
		Fine sa, w occas very thin sh streaks
713'		BASE OF COAL MEASURES
		Hard v fine gy sa, reported by driller to be gr when first exposed No dip readings poss, fracturing in first 6", and slickensiding at 721'6"
721'8"		

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.17/1950 STYX*

Location: BOWMAN, ABOUT 166°, 31 1/4 CHS FROM No.3 STATE MINE
Inclination & Direction of Hole:
Drill: *Size of Core:*
Drilling Period: 8.4.'50 to 29.'50
Drill Foreman: T.O. LEWIS
Logged by: S.R.L. SHEPHERD, DIST GEOL & J.D. EAST GEOL.
Plotted by: D.W.S.

Depth	Section	Description
		Soil, sand, clay & gravel (no core)
675		
686'		Sh
		Fine Sa
1'9"		Sh ? (no core)
1'5"		
1'7"		Very fine Sa
1'86"		Fine Sa
121'		Dark Sh
		Sa ? (no core)
12'8"		
		Fine & medium Sa
		Thin Sh streaks in section 153'6" - 165
191'6" 192'5"		Coaly Sh.
		Fine Sa with odd Sh. bands
199'6"		
202' 201'10"		Sh slickensided Coal 2"
204'8" 204'6"		Fossiliferous Sh
208' 207'4"		Fine Sa Coaly Sh
		Fine Sa with Sh streaks
		Sa with Sh streaks

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.17/1950 STYX*

Depth	Section	Description
Continued from previous column		
		Sh with sandy bands
238'		
		Medium Sa
240'6"		
		Sh with sandy bands Dip 5°
244'		
		Fine Sa with Sh bands
245'		
248' 247'5" 247' 248'6"		Fine Sa Coal 7" Coaly Sh Sh
251'6"		Fine Sa with Sh bands
		Fossil Sh with Sa streaks
		2" Coal at 254'4", slickensiding
257'10"		
		Medium Sa
271'6"		
		Fine Sa with Sh streaks Dip 10°
278' 278'6" 278'		Coal 6" Coaly Sh
		Black Sh Dip 5°
284'3"		
		Fine Sa with Sh streaks Slightly green tinge
293'		
293'		Black Sh
		Very fine Sa
296'6"		
		Medium Sa
304'10"		
307' 306'6" 308'6"		Sh slickensided Coal 6" Sh Coal 6"
310'5" 311'6"		Sh Coal 1'1"
314'		Sh & very fine Sa, slickensiding
		Fine Sa
326'		
		Fine Sa with Sh streaks Dip 10°
1'9"		
		Sh very occasional thin coal streaks
		Slickensiding at 331'
334' 333'6" 334'9"		Coal 5" Sh Coal 5"
336'		Sh
339'6"		Very fine Sa
343'		Sh with sandy bands Core partly fragmentary & slickensided Coal 341'6"-342'
		Very fine Sa with Sh bands Slickensiding
349'9"		
354'		Fine Sa
356'10"		Thin interlamin of Sa & Sh Dip 6° Slickensiding
359' 357'4"		Fossiliferous Sh Coal 1'8"
363'		Hard dark Sh
		Dark, very fine Sa & Sh Occasional slickensides
370'8" 371'5"		Dark Sh Coal 1'2"
373'6"		Dark Sh with coal bands in top 2'
379'4"		Coal ? 1'0"
384'6" 383'6"		Hard Sh with Sa bands Fine Sa with Sh bands
		Medium Sa
391' 391'10" 393'4"		Carbonaceous Sh Coal 1'4"
395'		Dark fossiliferous Sh with coal streaks
		Fossiliferous Sh becoming sandy at base
		Occasional coal streaks & slickensides
405'8"		
408'		Fine Sa
		Medium Sa
418'		
423'		Fine Sa with Sh streaks
		Medium Sa
432'		
434'3" 434'		Fine Sa with Sh streaks Irreg Sh inclusions 433'-433'3" Very thin coal sticks in bottom 6" Coal 3"
		Dark Sh with thin Sa bands Fossil fragments
442' 441'7" 441'4"		Bottom 2" coaly. Dip 10° Coal 7" Dark fossil Sh Slickensiding
435'		Fine grained Sa with thin irregular Sh streaks Dip 5°

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S 17/1950 STYX

Depth	Section	Description
Continued from previous column :		
445' 447'3"		Coal 2'3" Dark fossiliferous Sh with thin coal streaks
		Sh with very occasional thin Se streaks Very strongly slickensided 450'–451'
464'8"		Coal 2'2"
466'11"		Dark fossiliferous Sh. Slickensiding in top 6"
470'		Coal 10"
471'		Fossiliferous Sh. Top 6" carbonaceous
474'		Very fine Se with Sh laminations
477'8"		Sh with thin laminations of Se Dip 10°
479'3" 480'9" 481'9"		Coal 1'3" Coaly Sh Sh with fossil fragments
483		Sh.
483'		Dark Sh with fossil fragments. Thin Se stks in bottom 6" Slickensiding at 487. Dip 5° at 485', 13° at 488'; 10° at 488 6"
493'		Fine to medium Se Occasional slickensided calcite streaks
495'9"		Sh? (no core)
499'		Sh with Se bands. Fragmentary core
505'6"		Fine Se with green inclusions & numerous Sh streaks Slickensiding & calcite at 501' & 503".
508'		Dark Sh with numerous green Se laminations Dip 10°
511'		Dark, very fine green Se with numerous Sh lamina
514'		Dark, very fine green Se. & Sh.
530'		Dark Sh with thin slightly green laminations of Se Dip 10°
538'6"		Dark Sh with slickensiding
539'6"		No solid core (Sh?)
542'10" 543'6"		Dk Sh with coal stks at 541'6" Slickensiding at 540' Slickensided shaly coal 4"
546'10"		Very fine grey Se
549'9"		Fractured Sh with slickensiding & calcite Occasional coal streaks
558'3"		Sh with slightly sandy bands. Slickensiding 555'–557
562' 561'6" 561'		Sh with coal streaks Slickensiding Coal 6" Black Sh with coal streaks. Slickensiding
567'9"		Dark Sh with fossil fragments Slickensiding.
572'6" 573'6" 575'4"		Fine Se Occasional slickensides Sh Sh Fragmentary core Coaly Se Coal 10" with coaly Sh 574'9"–575' frag core
581'6"		Coaly Sh. Fragmentary slickensided core 10"
591'6" 593'		Sh with Se bands Core fragmnty & slickensided Calcite bands Fine Se
596' 598'		No core Dark Sh slickensided. Dip 5° Light gy Sh slickensided
608'9"		Light grey Sh with ferruginous bands Slickensided & fractured
612'		Very dk Sh with occasional coal streaks Slickensided Coaly Sh
618'6"		Sh. with sandy band (core 2'0")
620'8"		Dark Sh. Dip 12°
624'8"		Fine Se with Sh bands
627'5" 626'11" 627'9" 628'9"		Sandy Sh Dip almost vertical with slickensiding Coal 6" Coaly Sh. Slickensided Sh.
633'		Sandy Sh. Badly fractured
637'		Medium grey Se
642'2"		Sh. fractured (core)
644'		Sh with thin sandy bands
648'6"		Se with occasional Sh streaks
652'		Fractured Sh Dip 10°
653'2" 653'5"		Dark grey Sh Shaly Se
		Medium Se (core 20')

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S 17/1950 STYX

Depth	Section	Description
Continued from previous column :		
684'2"		Medium Se (core 20')
688'2" 687'2"		Sh (Slickensided fractured core) Sandy Sh
		Medium Se
698'2"		Dark Sh with ½" coal at top
708'2"		

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº N.S 18/1950 STYX

Location: Bowman, About 173°15', 306 chs. from No.3 State Mine
Inclination & Direction of Hole:
Drill: Size of Core:
Drilling Period: 23.9.'50 to 12.4.'51
Drill Foreman: T.O. Lewis
Logged by: S.R.L. Shepherd, Dist. Geol., & J.D. East, Geol
Plotted by: D.W.S

Depth	Section	Description
		Sand, clay & gravel (no core)
71'		Grey medium Se
96'		Sh – partly sandy
107'		Se
111'		Sh with sandy streaks (111'–119)
123'6"		No core
127'8"		Sh
133'9"		Medium Se
141'		Sandy Sh with Se bands
149'		Coal 2'6" including 2" Sh at 149'6"
152'6" 151'6"		Slickensided coaly Sh Sandy Sh Ferruginous Sh
156' 155'6" 155'		Sh Coal 3'0"
160' 159'		Sandy Sh Se
166' 168'		No core Se
179'		Thin interlamination of Se & Sh
182' 181'5"		Coal 1" Fossiliferous Sh., sandy band 185'–185'6"
186'		Thin interlamination of Se & Sh Dip 7°
191'5" 191'		Coal 5" Sandy Sh
200'8"		Gy medium Se Thin coaly stks. 228'–229' 235'–236'

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.18/1950 STYX*

Depth	Section	Description
Continued from previous column :		
		Grey medium Se Thin coaly streaks 228'–229', 235'–236'
284'8"		Dark Sh. Sandy bands 293'6"–294', 296'–297' Slickensided at 293', Dip 7°
297'6" 299'4"		Coal 1'10"
		Dark fossiliferous Sh. Dip 10°
317' 318'1"		Sh. with thin Se streaks
321'8"		Coal 3'7"
		Dark fossiliferous Sh. Dip 7°
328'		Thin interlamination of Se & Sh
331'6"		Se with disseminated green mineral
335'		Occasional Sh. streaks Thin interlamination of Se. & Sh.
339'6" 339'		Green mineral in Se. Fine Se with Sh stks. Green mineral in Se
342'		Sh.
		Fine Se. with green mineral & numerous Sh. streaks
351'1" 350'6"		Coal 1½" & Sh. with coal streaks
354'		Sh.
357'		Fine Se
358'		Sandy Sh
362'		Sh.
364'		Thin interlamination of Se & Sh
367'		Sh. with 3" coal at 364'9"
		Fine Se. with numerous thin Sh streaks
379' 379'9"		Coal 1'9"
		Dark fossiliferous Sh. with coaly streaks 389'–389'9"; 378'9"–379' Slickensided
400'6"		Sh partly sandy. Slickensided
408'4" 407'		Sdy Sh. Fractd Se. with coaly streaks
410'10" 410'4"		Sdy Sh. Fossiliferous Sh. Slickensided
413'		Coal 2'2".
417'		Sdy Sh, slightly carboneceous. Highly slickns'd & fractured. (core 2'6" fragmentary)
		Sh. Highly slickensided & fractured
423'		
426'		Se Highly slickensided & fractured
		Sh. with ferruginous bands Highly slickensided 2" coal at 428'2" (fragmentary core 6'2")
434'6" 435'8"		Shaly Coal 1'2"
443'		Fractured Sh. Thin interlam. of Se & Sh. Dip 3°–5°

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.18/1950 STYX*

Depth	Section	Description
Continued from previous column :		
446'		Thin interlamination of Se & Sh. Dip 3°-5°
		Fractured Sh. 2" coaly at 447'6" Dip 10°
452'6" 453'8"		Dark Sh. with coal streaks. 1" coal at 453'7"
454'7" 456'		Dark Sh. with Se. stks. 455'–455'6". Slickensided Coal 7"
		Dark Sh. Irregular 1" coal band at 462' Slickensided Dip 5°
467'		Thin interlamination of Se. & Sh.
473'		Dark Sh. Core partly fragmentary
478'2" 478'		Coal 2"
483'		Dark fossil. Sh 3" coaly Sh at 480'8"
		Grey Sh. Dip 3°
505'		Fine Se
511' 5.26"		Fine Se with thin Sh streaks
		Medium & coarse Se
530'6" 53.6" 533' 532'6"		Very coarse Se Coaly Sh. Ferruginous Sh. Fossiliferous Sh with odd coal stks. Slicksid.
536'		Fine Se with thin Sh streaks
549'		Irregular Sh. inclusions at 543'6"
		Sh. Small amount green mineral at 558' & 561'–562'. Dip 3°
576'		
		Sh 3" green band at 592'
598' 599' 600'		Sandy Sh. Green Se
		Se with numerous thin Sh streaks Dip 6°
615'		
		Se with Sh bands Irregular Sh inclusns 616'–616'
626'		
		Fossiliferous Sh with Se bands in bottom 16"
632'6" 633'8" 634'3" 636'		Fine & medium Se. Fossiliferous sandy Sh Fine Se.
		Fine Se with thin Sh. bands
642'6"		
		Medium light grey Se with occasional thin Sh. bands
649'6"		
		Fine Se with very thin Sh streaks thr'out Dip 5°

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.18/1950 STYX*

Depth	Section	Description
Continued from previous column :		
		Fine Se with very thin Sh stks throughout Dip 5°
695'		
		Fine Se with tiny thin wavy streaks of Sh
706'		
		Fine Se with occasional sandy Sh. bands
718' 717'		Dark grey Sh with Se bands
		Fine Se with sandy Sh. bands
730'		Medium Se
734'		Fine Se with thin wavy streaks of Sh
740'		Fine Se with sandy Sh. bands
750'		Fine Se with tiny thin wavy streaks of Sh.
760'		Dark Sh with thin bands of Se Dip 4°
765' 764'7" 765'8"		Coarse Se containing occas green parucles ferrug sdy Sh
768'		Dark grey Sh. Dip 5°
		Very fine dark grey Se with occasional Sh bands
774'		Dark grey Sh.
777' 776'		Dark grey very fine Se
779'		Dark grey Sh, partly ferruginous
		Dark grey very fine Se. with Sh. bands Very slight traces of green min 9" Sh band at 789' Slickensiding at 785'
792'		
		Light grey fine Se.
796'		
		Grey fine Se with occasional Sh bands
809'		
		Fine grey Se with occasional streaks of Sh
824'		
		Dark grey Sh. with streaks of Se
830'		
		Fine–medium Se fractured lengthwise Shaly bands 839'–840'. 2" Sh at 846'6"
850' 849'		Sandy Sh
		Medium & coarse Se with very small irregular coaly streaks in bottom 9" Coal 3"
855' 854'9"		Med–coarse Se. Dk gy. Very small irreg coaly stks
858'		Dk gy grit. Very small irregular coaly streaks
862'4" 862'		Coal 4"
864'		Dark fossiliferous Sh., slightly sandy
868'		Fine dk gy Se 2" fossiliferous Sh band at 865'3"
872' 871'		Conglomerate. Pebbles up to 1" diameter Dark Sh with thin coal bands. Sub-horizontal
873'6"		Dark Se.
879' 878'		Dk foss Sh with Se bands & odd coal stks. Slickd at 5° Dark fine Se. Slickensided
882'		Fine–med Se (core 2'0", driller reptd 1'0" conf bands) BASE OF COAL MEASURES.
885' 886'		Hard dense Se Greenish tint. Grit ? Dip 17°
		Fine hard Se with occasional Sh bands. Somewhat fractured & slickensided. Greenish tinge Ferruginous markings at 904', 907'; 913'–915'
		Not possible to determine dip of basement rocks
917'		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.18/1950 STYX*

Depth	Section	Description
Continued from previous column :		
917′		
		Medium Sa, greenish tinge
931′		*Bottom*

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.19/1951 STYX*

Location: *Bowman, about 162°45′ 3/8 chs. from No 3 State Mine*
Inclination & Direction of Hole:
Drill: ____ **Size of Core:** ____
Drilling Period: *9.7.'51* to *31.8.'51*
Drill Foreman: *T.O. Lewis*
Logged by: *S.R.L. Shepherd Dist Geol. & T.D. Dimmick Geol.*
Plotted by: *D.W.S.*

Depth	Section	Description
80′ 79′		*Fine grained Sa*
		Sa with interleminsted Sh bands
86′ 85′		*Sandy Sh*
		Med. to fine grained Sa
		Occas. small Coal streaks
		Green mineral throughout whole core
		General Dip 3°
55′6″		*Fine Sa with odd Sh bands*
160′		*Light grey Sh*
163′9″		*Grey med Sa*
177′8″ 177′2″ 177′		*Coal 2″ Carb Sh with coal streaks*
179′		*Fine Sa with Sh bands*
181′6″		*Sh slickensided (broken core)*
		Fine Sa with odd Sh bands
187′ 188′3″		*Sh slickensided slightly*
191′		*Fine, med grey Sa*
		Alternating Sa & Sh
196′6″		*Dark grey Sh. with odd Sa bands*
201′6″		*Med grey Sa*
204′ 204′2″ 207′7″		*Sh - Dip 3° Coal (4″)* Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.19/1951 STYX*

Depth	Section	Description
Continued from previous column :		
207′7″		*Sh*
209′		*Sandy Sh*
210′6″		*Fossil Sh*
213′6″ 213′		*Sandy Sh*
215′6″ 214′9″		*Fine Sa with odd Sh bands*
217′6″		*Carb Sh with Coal bands*
218′		*Sandy Sh*
222′		*Fine grey Sa*
223′6″		*Sh. - 1″ Coal at 222′*
224′6″		*Med Sa*
226′		*Carb Sh - fossiliferous*
		Med. grey Sa
		Med. grey Sa
240′		
242′ 243′7″		*Fine grey Sa*
245′6″		*Sh. - Dip 4° Coal (6″)*
		Carb Sh with coal bands
250′6″		*Black Sh. - Dip 3°*
258′ 284′		*Fine grey Sa - odd Sh bands*
257′6″ 257′8″		*Sh with Sa bands*
		Dark grey Sh
262′ 263′		*Sa band*
263′8″ 265′		*Sh.*
268′6″		*Sa Dark grey Sh.*
271′6″ 272′2″ 273′2″		*Coal (1′4″) Dark grey Sh - fossil*
		Fine grey Sa
276′3″ 277′		*Dark grey Sh - fossil*
		Fine Sa. Dark grey Sh. - fossil
282′		*Fine grey Sa*
		Sh. sandy - fossil
287′		*Grey Sa with Sh bands*
289′ 290′ 291′		*Alternating Sa. & carb Sh bands*
		Black Sh
		Grey Sh Black Sh
		Grey Sh (9′ core) broken
301′6″ 303′		*Sa with Sh bands*
		Med grey Sa
318′6″		
324′6″		*Grey med Sa with odd coal streaks*
		Dark grey Sh. fossil. with sandy streaks
		Coal streaks 333′3″
		Dip - sub-horizontal, max 3°
335′6″ 335′		*Coal (6″) with Sh. bands*
		Med. grey. Sa
341′6″ 340′8″		*Carb. Sh. with coal streaks*
		Fine Sa with Sh. bands - fossil
348′3″		*Med grey Sa*
355′		*Fine grey Sa with Sh. bands*
358′		*Black carb Sh*
362′4″ 362′		*Coal (4″)*
365′		*Dark grey Sh. (core fragmentary)*
369′ 368′4″ 368′		*Fine grey Sa with small Sh bands*
370′10″		*Carb. Sh. Coal (8″)*
372′ 371′9″		*Grey Sh Coal Black carb Sh*
374′3″ 373′3″		*Fossil Sh.*
376′3″		*Fine Sa*
378′1″		*Sh. with fossil fragments - Dip 3°*
379′6″		*Coal*
		Carb Sh with coal streaks - slickensided
		Med grey Sa
390′9″ 392′		*Coal*
		Dark grey Sh with coal streaks - fossils
400′6″		*Fine sandy Sh - fossil*
408′6″		
		Fine Sa with carb streaks
		Sh. bands 414′ - 415′
427′		*Thin interlamina Sa & Sh. fossil - horizontal*
429′3″		*Fine Sa with Sh. streaks Carb Sh. Coal (3″)*
432′ 431′9″ 431′6″		*Black Sh. - fossil*
437′7″ 437′4″ 438′7″		*Fine sdy. Sh. Carb Sh. (1″ Coal 437′7″ - 437′8″) Coal (6″)*
		Fine Sa with fossil fragments.
441′6″ 441′		*Coal (3″) Dip 2° Continued in next column*
		Lt. grey carb Sh. foss

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.19/1951 STYX*

Depth	Section	Description
Continued from previous column :		
446'8" 448'10"		Dark grey carb. Sh. fossil. – Dip 2°
		Coal
453'6"		Grey carb. Sh. Dip 2°
		Laminated Sh.
464'2"		Coal
465'8"		Dark grey Sh
471'4"		Sandy Sh
483' 482'8"		Very calc. Sh. Sh.
485' 484'1" 484'5"		Se Very inferior coal 484'1"–485'1"; Coaly Sh. 485'1"–485'4"
		Sh
492'6"		Se with Sh. bands
497'11" 499'2"		Sh
501'4"		Green Se
503'8"		Bands of green Se & Sh.
506'6" 508'1"		Bands Se & Sh Sh. slightly sandy
512'6"		Green Se with thin Sh streaks
		Grey Sh. Dip 10°
520'6"		Dark Sh., fragmentary core
523'11"		Se. with thin coal bands 527'2"–527'9"
528'3"		Dark grey Sh.
531'6"		Sh. with Se. bands – Dip 10°
537'		Sh slickensided
542' 543'1"		Se.
544'8"		Coal with 3" ironstone at 543'6"
546'6" 547'6"		Sh. with coaly streaks Se. with Sh. streaks – Dip 10°
		Sh.
555'3" 556'6"		Carb. Sh. with coaly streaks
561'		Bands of Se. & Sh.
		Carb. Sh with coaly streaks
568'2" 566'7"		Coal
570'8" 570'		Carb. Sh. with coaly streaks Coal
573'		Carb. Sh. with coaly streaks
576'		Sh.
580'8" 580'		No core – Sh.? Sh. Coal
583'		Sh.
587'		Sandy Sh
591' 590'4"		Sh.
593'		Coal
595'1" 595'8"		Carb. Sh.
		Sh Coal
603'		Dark grey Sh. – Dip 5°
		Bands of Se. & Sh
613'		Se with Sh bands & calcite veins Slickensided & broken – Dip 15°
618'		Sh. slickensided, fragmentary core
624'6" 628'11"		Very inferior coal
		Sh highly contorted & with calcite veins
633'		Sh slickensided & contorted Dips up to 45° Fragmentary core 4"
640'		Bands Se & Sh; contorted & slickensided Dips up to 80°, core 7"
651'		Sh. slickensided
680'		Bands of Se & Sh; Dip 20°
676'		Se

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.19/1951 STYX*

Depth	Section	Description
Continued from previous column :		
		Se
687'6" 688' 690'		Bands of Se. & Sh., calcareous Se
693'		Se with Sh. bands, highly contorted from 691'6"–692'
697'3" 697'		Se with Sh. streaks; slickensided
699'		Sh. Coal
703'3"		Sdy. Sh with coal streaks 700'–701'3"; Dip 7°
706'6"		Bands Se & Sh.
709'		Se
		Se with Sh streaks. Dip 15°
		Coal streaks at 712'10", 717' & 720'8"
728' 729'		Sh with Se streaks; slickensided

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.20/1951 STYX*

Location: *Bowman. About 163°45'. 337chs from No 3 State Mine*
Inclination & Direction of Hole:
Drill: Size of Core:
Drilling Period: *23.4.51* to *29.6.51*
Drill Foreman: T.O.Lewis
Logged by: S.R.L. Shepherd Dist. Geologist & J.D.East. Geol
Plotted by: D.W.S.

Depth	Section	Description
		No core
88'		Sand, gravel & clay
		Fine & medium Se with slightly gr. tinge Green reported to be very prominent when first exposed Sh streaks in section 92'–94' Sandy Sh band 97'6"–98'6" Irregular Sh. inclusions 119'6"–120' Dip at 160'–5°
174'6" 176'6" 178'		Coarse Se Cse. Se with irreg. Sh inclns & irreg stks of coal
183'		Fossiliferous Sh with 1½" dirty coal at 182'4" Bottom 6" coaly
185'		Sandy Sh. with Se. streaks
188' 187'		Fine Se. Sandy Sh with irreg. Sh. inclusions
190'		Sh slickensided at 190'
193'6" 193'		Fine Se Very fine Se
		Sh. fractured & slickensided 6" fine Se at 196' (core 3'0")
201' 203' 205'		Cse. Se with irreg. Sh inclns. & Sh streaks Very fine Se Sh.

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.20/1951 STYX*

Depth	Section	Description
Continued from previous column :		
211′		Sh.
		Medium Se
215′ 216′7″ 217′		Fossilferous Sh Coal 7″ Sh with coal streaks
		Sh, slickensided at 218′
221′		Very fine Se with Sh bands
222′6″		Sh with coal & sandy stks (Coal at 222′11″
225′		Slickensiding Dip 5°
		Fine Se with numerous thin streaks of Sh
230′		Foss. Sh & sandy Sh. with odd coal streaks
233′ 234′		½ Coal at 231′ Slickensiding
		Fine Se
		Medium & coarse Se
243′		
		Fine Se with numerous fossiliferous Sh stks
		244′9″-245′3″ streaks are vert disposed
		Dip at 247′-9°
252′6″ 253′9″		Se with numerous thin streaks of coal
		Dark Sh Top 6″ slickensided Fossiliferous
		Dip 8°
260′6″		
264′		Fine Se with Sh streaks Slickensiding at 262′
269′		Sh, slickensided with 2″ ferruginous band
271′		Fine Se
273′		Medium Se with slight green tinge
		Medium Se with thin black Sh streaks
278′1″ 279′		Coal 1″
283′		Dark fossilferous Sh Slickensided
285′ 286′		Dk gy Sh
		Fine grey Se with few Sh. bands
		Fine grey Se
292′6″ 293′6″		Dark grey sandy Sh.
297′		Thin interlamination of Se & Sh
		Fine to coarse light grey Se with coaly streaks at 330′-332′ 334′-335′4″ 345′-346′
		Se fine grained near top; medium to coarse 307′-356′6″
356′8″		
		Medium to coarse light grey Se
367′ 368′3″		Light grey Sh
		Medium to coarse light grey Se occasional small coaly streaks near base (417′-418′)
418′3″ 418′6″ 420′6″		Coal Dk gy Sh with coal stks Dip horiz to 3°
424′4″ 424′4″		Thin interlam of Se & Sh. with coaly streaks
426′10″ 426′4″		Fine fossil Se. Coal Dark carb Sh
432′2″ 433′6″ 432′8″		Grey fossil sandy Sh.
435′2″ 435′10″ 436′6″		Coal Carb Sh with coal streaks
440′		Light grey Sh. fossiliferous
		Coal 4″ Black Sh with coal streaks
		Grey Sh. (core!)
		Fine-medium grey Se

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.20/1951 STYX*

Depth	Section	Description
Continued from previous column :		
		Fine – medium grey Se.
451′3″ 451′3″		Se. & Sh. bands Black carb. Sh (Dip horiz)
452′4″ 453′8″		Coal
		Black carb Sh ; fossiliferous
461′3″		
463′3″		Interlamination of Se & Sh
		Fine to medium grey Se (with occasional Sh streaks)
500′10″ 501′1″		Black carb Sh, slickensided
503′		Coal
		Dark gy Sh (Dip 6°) with occasional Se streaks
509′		
511′3″		Thin interlamination of Se & Sh
512′10″		Coal 511′3″-511′1″; Carb Sh. 511′1″-512′4″; Coal 5.24″-5′2′10″
514′		Grey Sh, slickensided
516′8″ 517′4″		Fine to medium Se
518′		Dark grey Sh., slickensided
521′		Coal
524′3″		Grey fossil. Sh.
		Thin interlaminations of Se & Sh
		Dark grey Sh with few thin sandy bands Dip 8°
542′6″ 542′9″		Se Carb Sh with coal streaks
543′3″		Black Sh., fossiliferous
547′2″ 547′9″		Coal Black Sh with coaly streaks, fossiliferous
548′		Dark grey Sh
553′		Thin interlaminations of Se & Sh
557′6″		
559′8″ 559′11″		Dark grey Sh with Se streaks Coal
561′8″		Carb Sh with coal streaks (Dip 25°)
563′9″		Dk gy Sh., fossil fragments (Dip 25°)
		Thin interlamination of Se & Sh.
568′6″		
572′		Fine Se, Sh. streaks at base
574′6″		Bands of Se & Sh
578′ 578′6″		Fine Se with Sh streaks
580′		Bands of Se & Sh
583′		Dark grey Sh
586′		Bands of Se & Sh
		Sh with Se streaks
		Fine Se with Sh streaks
		Badly broken 593′-594′, Dip 20°
		Dip up to 40° from 586′-588′
598′9″		
600′8″		Sh with Se streaks
605′		Fine to medium Se
607′6″		Bands of Se & Sh
610′1″ 610′2″		Black Sh
613′4″		Coal
614′4″ 615′4″		Grey sandy Sh
		Coal Bands of Se & Sh; Dip 20°
		Sh
622′3″ 622′9″		Coal Black Sh
628′7″		Fine Se
627′6″		Grey Sh.
630′6″ 631′		Coal
633′3″		Dark grey Sh, slickensided
635′8″		Coal
639′		Dark Sh with Se bands
		Fine to medium Se with thin Sh bands
649′		
		Bands of Se & Sh ; Dip 5°
654′5″		
657′5″ 658′5″		Fine to medium Se with thin Sh. bands
659′2″		Coal No core
662′7″ 663′		Bands of Se & Sh. Coal
666′		Black Sh. with Se streaks, Dip 5°
		Bands of black Sh. & fine Se
670′11″ 671′5″		Coal Sh, with fossils
672′6″		Fine grey Se. with coaly streaks
677′		Sandy Sh., sl/kns'd & with fossils

583′-622′ strata sharply folded & broken

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE Nº *N.S.20/1951 STYX*

Depth	Section	Description
Continued from previous column :		
682′		Sandy Sh., slickensided & with fossils
683′6″		Carb Sh, highly contorted
685′ 686′		Se with coaly streaks; slickensided
		Dark grey Sh
688′6″		Bands of Se & Sh.
692′3″		Fine Se (coarse with coaly streaks 689′3″-690′)
		Fine Se with coaly streaks
702′3″		Bands of Se & Sh., Dip 5°
706′		
709′6″ 710′		Medium grey Se (fragmentary core) Bands of Se & Sh. Dip 4°
		Fine to medium grey Se
727′5″ 727′		Coal Black Sh, fossiliferous
729′		
		Fine to medium grey Se with irregular Sh bands
742′6″		
745′6″		Bands of Se & Sh (horizontal)
		Dark grey Sh with occasional sandy bands
754′6″		
		Sh with few irregular sandy bands. Fossils. Dip 3°
778′		BOTTOM

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS.21/1951 STYX*

Location: *BOWMAN. ABOUT 169° 39.0 CHS FROM No.3 STATE MINE.*
Inclination & Direction of Hole: *VERTICAL*
Drill: *SULLIVAN N No2* **Size of Core:** *NX*
Drilling Period: *7-9-51* **to** *1-10-51*
Drill Foreman: *T.O. Lewis*
Logged by: *T.D. Dimmick Geologist & S.R.L. Shepherd*
Plotted by: *J.S. Douglas* *District Geologist*

Depth	Section	Description
		No core
39'		
42'		Brown sa. (fragmentary core)
44'		Grey sh
45'6"		Grey sa
		Grey sh (frag core)
70'		
72'		Grey sh with coal streaks
		Sh (frag core 2'6")
87'9"		
		Grey sa (core 3'6")
101' 100'		Sh with coaly streaks. Thin bands sa & sh
102'		Grey sa, slickensided.
103'6" 105'6" 105'		Coaly sh. Bands of sa & sh
		Sa with sh. bands.
114'6"		
118'		Black sh.
120'		Sh with sa bands
122'9"		Sa. with green minerals & sh streaks (dip 5°)
		Bands of sa & sh
127'10" 126'10"		Coal.
132'		Sh with coaly streaks (core 4").
		Alternating bands sa & sh ¾" coal with calcite at 152'.
157'		
162'		Grey sh
164'9"		Grey sa with sh streaks.
		Grey sa; coarser towards base.
177'6"		
		Sa with sh bands.
185'		
186'9"		Calcareous sh. with calcite veins.
		Bands of sa & sh.
192'		
194'		Carb sh with coaly streaks.
195'6"		Coal.
196'3" 197'6"		Sa with thin coaly streaks (core 1'6")
200'		Sh. (core 6"). Carb sh with coaly streaks
202'		Sandy sh
		Grey sa, coarse 207'-208'

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS.21/1951 STYX*

Depth	Section	Description
Continued from previous column:		
221'		
225'6"		Laminated sa (dip 0-5°).
229'		Thin bands sa & sh.
230'9" 232'6" 232'		Grey sa Coal Coaly sh
		Grey sh (core 3'6")
238'4" 240' 239'8" 239'7"		Carb sh Coal Carb sh
243'3"		Grey sh with coal streaks
		Grey sa
266'6" 266'		Coal, inf coal & sh (fragmentary core)
		Grey sh
275'		
277'9"		Sa & sh
		Grey sa
288'		
291'		Sa with sh bands
293' 293'10" 295'7" 294'6"		Grey sa (core 6") Gy sh (core 4") Grey coaly sh {Inf. coal 293'10"-11", Coal 293'11"-294'9", Inf. coal 294'9"-10"}
		Dark grey sh (sub-horizontal)
307' 306'4"		Carb sh 306'4"-5"; coal 306'5"-7"; carb sh 306'7"-307'
310'		Grey sh (top 8" sandy)
312'		Calc sh with calcite veins.
		Bands sa & sh (dip 7°)
317'6" 318'9"		Carb sh 317'6"-10", coal 317'10"-8", coaly sh 317'11"-318'5", coal 318'5"-7"; coaly sh 318'7"-9"
322'6" 322'		Grey sh Coal
		Dark grey sh (core 6")
329		
		Dark gy sh with sa laminae (sub-hor.)
336'6"		
		Dark grey sh
340'9" 342'9" 342'		Bands sa & sh Grey sa 342'-342'9".
		Coal. (inf coal ½" at 347'0½")
348'1" 348'1"		Carb sh
		Dark grey sh
354'		
356'		Bands green sa & black sh
358'		Sh with sa bands, slickensided
360'		Green sa with bands black sh
		Thin interlamination sa & sh
370		
		Grey sa with occasional sh bands
378'		
381'6"		Grey sandy sh (fossil fragments)
		Thin interlam sa & sh
409' 408'		Dark grey sh
		Thin interlam sa & sh.
419'2"		
423'2"		Coal
		Grey sh
427'9" 427' 428'9"		Fine grey sa Coal
		Grey sh., fossil; (black carb sh 437'6"-439'6").
443'6"		

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS.21/1951 STYX*

Depth	Section	Description
Continued from previous column:		
447'6"		Dark grey sh
		Med. grey sa.
454'6" 456'8" 456'4"		Coal. Black carb sh
		Black carb sh
461'8" 461'4"		Coal
466' 467'3"		Dark grey sh (dip 3°) Coal
		Dark grey sh
475'2" 475'		Coal
		Thin interlamination sa & sh. (dip 3°)
480'10" 480'5" 483' 482'6"		Coal. Grey sh. Thin interlam sa & sh
		Thin interlam sa & sh
491'6" 493'6"		Grey sh
		Thin interlam sa & sh
500' 502'4" 502' 504'		Coal Grey sh Grey sh.
		Thin interlam sa & sh
5		

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS 23/1951 STYX*

Location: *Bowman About 163°30' 400 ch from No 3 State Mine*
Inclination & Direction of Hole: *Vertical*
Drill: *Sullivan N No 2* **Size of Core:** *NX*
Drilling Period: *7-8-51* **to** *4-12-51*.
Drill Foreman: *T O Lewis*
Logged by: *S R L Shepherd District Geologist*
Plotted by: *J S Douglas*

Depth	Section	Description
0		Surface soil (no core)
71′		Sa, med-coarse (green mineral)
135′		Grey sdy sh (2′ core)
139′		Sa, med-coarse (green mineral).
132′ 151′		Shaly sa, fine, grey (fossil fragments)
		Sa, fine, grey (coarse 152′-152′3″).
155′3″		Sh (with thin interlamination sa 157′9″-159′3″).
159′3″		Sa, fine, grey
162′7″		
		Sa, coarse-med, light grey.
95′		
		Sh, grey.
205′ 204′6″		Sa, med, grey
207′ 207′6″		Sh, grey
		Sa, med, grey

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS 23/1951 STYX*

Depth	Section	Description

Continued from previous column:

210′	Sh, grey (fossil fragments).
212′	Sa, med, grey
215′	Alternating sa & sh
217′5″ 217′1″ 218′4″	Sh, dark grey (fossil fragments) Coal 4″
	Sdy sh (broken)
	Sa, med-coarse, light grey.
228′	
232′	Alternating light grey med sa & sh bands.
235′5″ 235′ 235′9″	Sa, light grey Sh, grey.
	Coal.
241′	Sh, light grey (fossil fragments).
246′	Sa, med, light grey.
253′3″	Sh, dark grey; sdy in patches (fossil fragments) Dip 5°.
255′7″	Sa, coarse, green.
257′	Alternating sa & sh
259′	Sh, dark grey.
261′	Alternating sa & sh
262′6″	Sa, med, light grey.
266′3″	Sh, dark grey & occasional sa bands (foss frags).
268′	Sa, fine grey with sh bands
	Sh, dark grey.
275′ 274′	Sa, fine grey.
276′4″ 277′11″	Sh, dark grey (carb foss. frags), bands of sa.
	Coal Sh, dark grey, carb (fossil fragments)
281′	Alternating sa. & sh. bands.
282′6″	Sa, fine-med, light grey.
285′	
292′	Alternating sa & sh. bands.
297′ 296′	Carb sh, black, with coal streaks.
	Sh, grey (fossil), sdy in part.
302′11″ 302′	Coal Carb sh, dark grey (slickensided).
303′6″	Shaly sa, light grey
305′9″	Carb sh, dark grey (coal streaks).
306′9″	Shaly sa, fine.
309′	Sa, med, light grey
313′6″	Sh, hard, grey, sdy (fossil fragments). Dip 3°.
326′6″	Sh, dark grey (fossil)
331′6″	Sh, light grey.
333′	Sh, grey, sdy, coal streaks (fossil).
335′9″ 335′3″	Coal Carb sh, dark
337′6″	Sa, med, light grey (sh. streak).
340′	Sh, dark grey; carb bands (fossil).
347′6″	Sa, med, light grey (sh bands towards base).
360′	Sa & sh bands, alternating.
365′3″	Coal.
367′	Sh, grey (fossil). Dip 3°.
374′	Coal.
376′2″	Sh, grey, fossil (broken below seam)
378′2″	Sa, fine-med, grey.
394′	
395′8″ 395′2″	Carb sh, black. Coal
	Sh, grey; sandy in parts with coal streaks.
404′	Sa & sh, thin interlamination, sa predominating
415′6″	Sa, fine, grey, with odd sh bands
426′6″	
428′7″ 428′1″	Coal Sa & sh, thin interlamination.
	Sa & sh, thin interlamination. Dip 3°
435′	
436′6″	Coal
439′5″ 438′9″	Sdy sh, dark grey; odd thin coal bands.
	Coal Sdy sh, dark grey (core 3″).
442′	Sdy sh, gy (foss)

Continued in next column

QUEENSLAND
DEPARTMENT OF MINES
DRILL SECTION
BORE № *NS 23/1951 STYX*

Depth	Section	Description

Continued from previous column:

448′ 447′6″	Coal Sh, grey
449′	Sa & sh, thin interlamination.
452′	Sh, grey (fossiliferous)
457′	Sh, dark grey. Dip 3° (with small bands & irreg veins of sa, with green mineral, samples taken 460′ & 463′).
467′	Sh, grey, slightly sdy (fossil).
469′6″	Sa & sh, thin interlamination.
474′8″ 474′3″	Carb sh, dark grey Sa Coaly sh
475′5″ 475′	Sh, grey, slightly sdy. (fossil).
483′9″ 483′6″	Coal Carb sh with coal streaks
484′3″	Sh, grey (fossil fragments).
488′	Sa & sh, thin interlamination
492′	Coal
493′	Sa & sh, thin interlamination. Dip 3°
505′	Sa, fine, with occasional sh bands
509′3″	Sh, grey (fossil fragments).
513′	Sa & sh interlamination (sa predominating).
519′6″	Sa, fine grey.
522′	Sh, grey; occasional sa bands.
530′8″	Sa & sh, thin interlamination.
548′3″ 547′3″	Coal Sa, fine, light grey.
550′	Sh, grey.
561′6″ 560′6″	Sdy sh, fossil fragments
	Coal
567′	Sh, dark grey, fossiliferous (coal streaks)
570′6″	Sa, fine, with sh. bands.
574′10″ 573′8″	Coal
	Sh, dark grey.
579′	Sa, fine, grey.
585′	Sh, dark grey. Dip 3°.
589′2″	Coal.
590′8″	Sh, dark grey.
598′	Sa & sh, thin interlamination
605′	Sh, dark grey.
608′	Sh, light grey, with occasional sa bands.
6 4′6″	Sa, fine grey.
622′	Sh, dark grey (slickensided).
624′6″	Sa & sh, thin interlamination.
627′6″ 626′6″	Coal.
	Sa & sh, thin interlamination.
631′	
634′ 633′6″	Coal Sh, dark grey
635′3″	Coal Sh, grey (slickensided).
637′	Sa & sh, thin interlamination.
639′	Sa, fine grey.
641′2″ 641′	Coal Shaly sa
	Sh, dark grey.
645′ 645′5″	Coal Sa, fine grey Sdy sh, dark grey.
648′2″ 647′	Coal.
649′	Sa & sh, thin interlamination.
653′3″	Coal
655′	Sa & sh, thin interlamination.
659′8″ 658′6″	Coal Sh, dark grey
660′	Sh, dark grey.
662′	Sa, fine grey with sh bands
668′6″	Sh, grey (fossil).
671′	Coal
672′2″	Sh, dark grey (slickensided - core broken 672′2″-680′)
682′	

Continued in next column

A. H. Tucker, Government Printer, Brisbane.

FIG. 2

PLAN OF

TOOLOOMBAH CREEK AREA

STYX RIVER COALFIELD

Parish of Tooloombah, County of Murchison

REFERENCE

20 chain grid based on bore N.S 8 and magnetic north

oN.S.8 ..... bore sites

-200'- ..... contours on base of C seam showing depth below State Datum.

SCALE

FEET 800 400 0 800 1600 2400 3200

CHAINS 2 1 0 2 4 6 8

oN.S 18
RL 88.43'
C 19' 9" -
E 339.30-[illegible]
F 373.3-419'
Depth to basement 884'
Total depth 931'

oN.S 15
RL 88.14'
C (2776'-2733')
C 2746'-2756' (coal ysh)
E 3393'-3394'
F 4293'-4301'
Total depth 758'6"

oN.S 17
RL 88.78'
C 3756'-3794'
E 4649'-4657'
E 4658'-4661'11"
F —
Total depth 708'2"

N.S 19 o
RL 86.31'
C —
E —
F —
Total depth 729'

SURVEY DATA

Boreholes connected by a traverse commencing at a point on the southern boundary of Por 45 M, Parish of Stoodleigh, and bearing 268° 21'20" 298.5 links from original stn 46 (Vide Rkn 325) as fixed from orig ref tree.

Variation at Stn 50 (OSP 12) is 8°36' E.

Elevations on State Datum by subtracting 74.51 ft. from Railway levels on Rockhampton–Mackay Railway

The 20 chain grid is arbitrary and is based on magnetic meridian with the origin of the coordinates at N°8 Borehole

oN.S 12
RL 89 79'
C 2115'-2158'
E 3302'-3335'
F 3946'-397'
Depth to basement 844'2"
Total depth 1081'6"

oN.S 16
RL 85.32'
C 1469'-1519'
E 3309'-3355'
F 3417'-3458'
(ash 40'11")
Depth to basement 713'
Total depth 1218'

oN.S 13
RL 88.01'
C 3314'-3379'
E 2294'-2304'
F 501'-505'
Total depth 1088'8"

N.S 20 o
RL 89.70
C 4326'-4324'
E (4351'-4362'
E —
F 6333'-6359'
Total depth 778'

oN.S 9
RL 94.5'
C 3144'-3195'
E (4157'-4184'
E 4193'-4215'
F 4904'-4914'
Total depth 594'9"

N.S 8 o
RL 92.73'
C (1851'-1875')
C 1871'-1911'
E 3571'-3577'
F 3664'-3692'
Total Depth 660'

oN.S 14
RL 89.37'
C (3794'-3803')
C 3831'-3848'
E (4771'-4777'
E 4771'-4782'
Total depth 900'

N.S 10 o
RL 93.42'
C 1540'-1581'0"
E (2881'0"-2901'0"
E 2923'-2929'
F 2522'-2541'1"
Total depth 568'

oN.S 11 & 22
RL 79.47' (NS11)
C 2691'0"-2720' (NS22)
E (3641'-3668' (NS22)
E 3685'-3705'
F 439'-443' (NS11)
Depth to basement 1048' (NS11)
Total depth, 380' (NS22) 1200' (NS11)

oN.S.21
RL — not determined
C 2397'-2398'
E 3429'-3481'
F 4192'-4221'0½"
Total depth 512'

N.S.23 o
RL — not determined
? 3743'-3762'
E 5616'-567'
Total depth 735'

Tooloombah Creek
Main channel
Densely vegetated island (permanent)
Outer
Bank
sa & sdy sh in creek bed
Gravel bank to 10' high
Outer
Bank 30' high
sa cliff 10' high
sa & sdy sh intermittently exposed
sh & sdy sh intermittently exposed
A coal crop
coal 15' 20'
-100'
-200'
-300'
T.N.
M.N.
1955

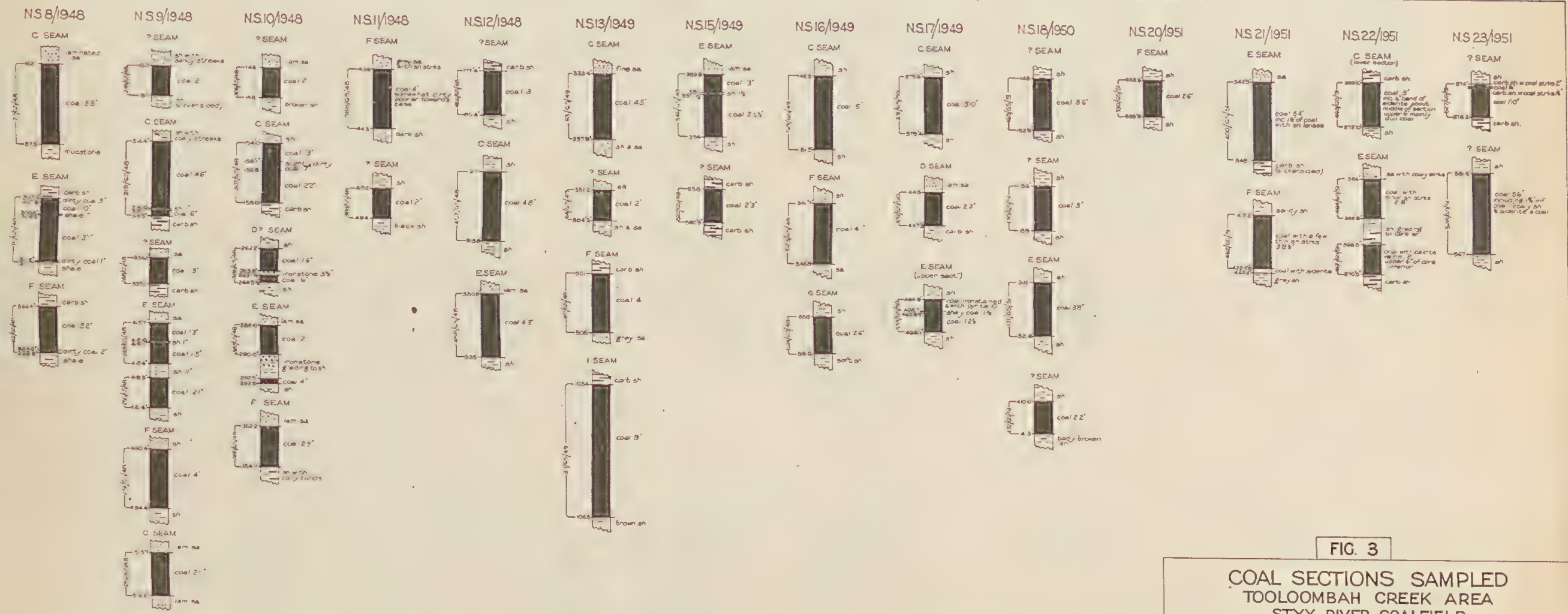
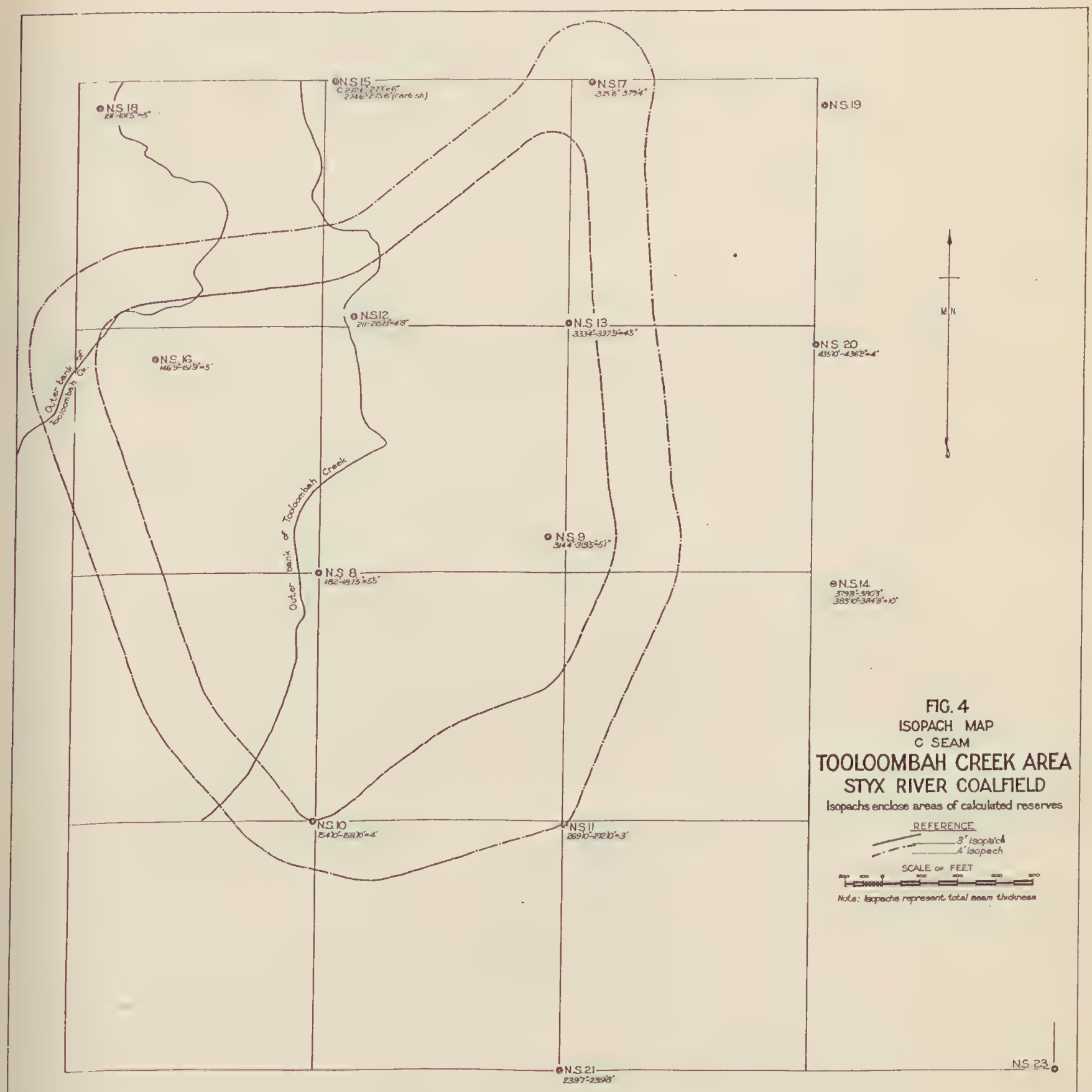


FIG. 3

COAL SECTIONS SAMPLED
TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD

Drawn at the Dept of Mines, Brisbane, 20/4/54
See Table of Analyses—Table I


N.S.15
C 2174'-2173'=6'
2146'-2136'(carb sh)
N.S.17
3756'-3794'
N.S.19
N.S.18
3741'-3745'=5'
N.S.12
2112'-2158'=48'
N.S.13
3334'-3379'=45'
N.S.20
4351'0"-4362'=4'
N.S.16
4169'-4179'=5'
Outer bank of Tooloombah Ck.
Outer bank of Tooloombah Creek
N.S.9
3144'-3193'=51'
N.S.8
1824-1873'=53'
N.S.14
3798'-3903'
3851'0"-3841'8"=10'
N.S.10
5410'-5381'0"=4'
N.S.11
2690'-2710'0"=3'
N.S.21
2397'-2398'
N.S.23
M.N.
FIG. 4
ISOPACH MAP
C SEAM
TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD
Isopachs enclose areas of calculated reserves
REFERENCE
3' isopach
4' isopach
SCALE OF FEET
Note: Isopachs represent total seam thickness

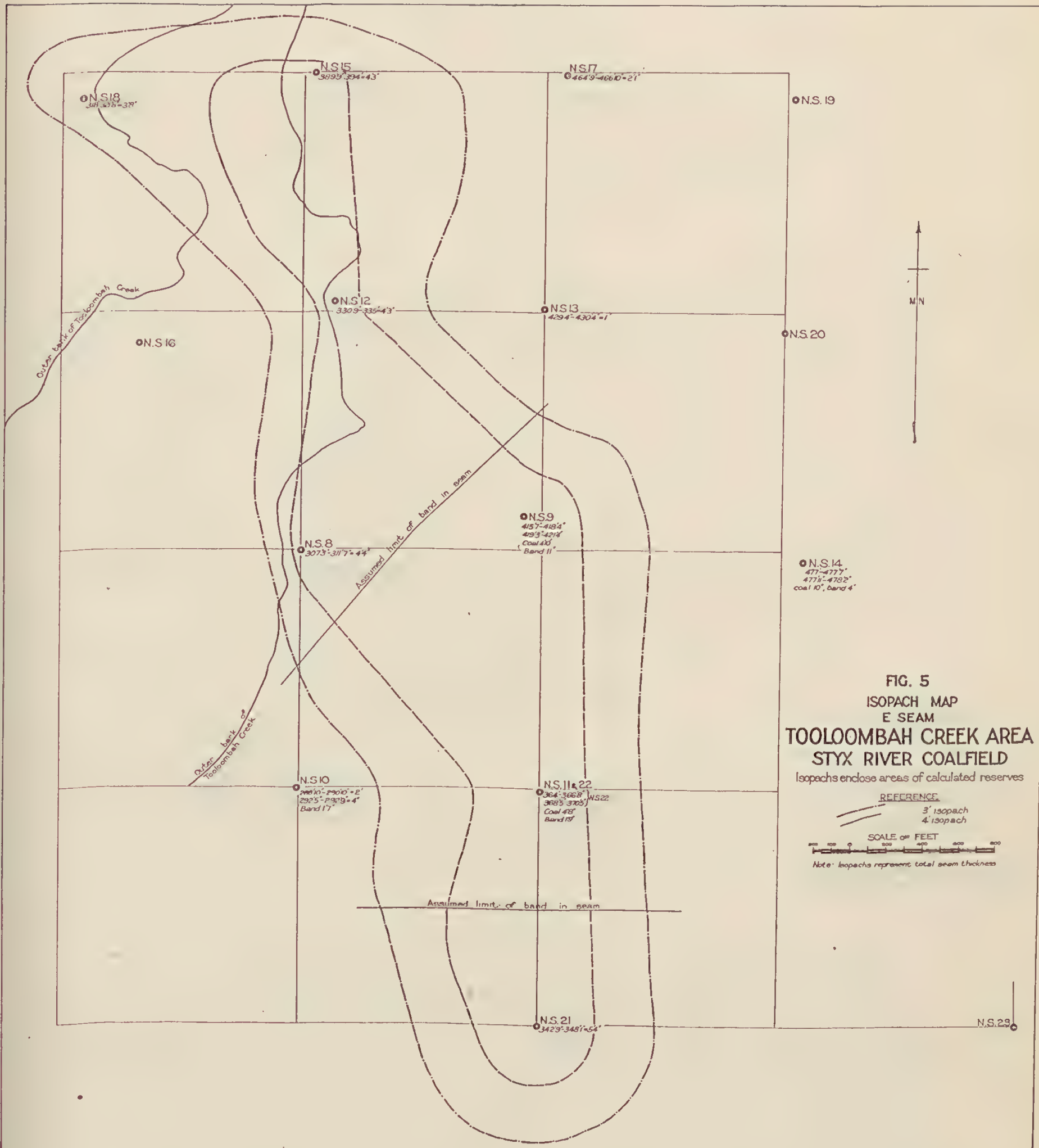


FIG. 5

ISOPACH MAP

E SEAM

TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD

Isopachs enclose areas of calculated reserves

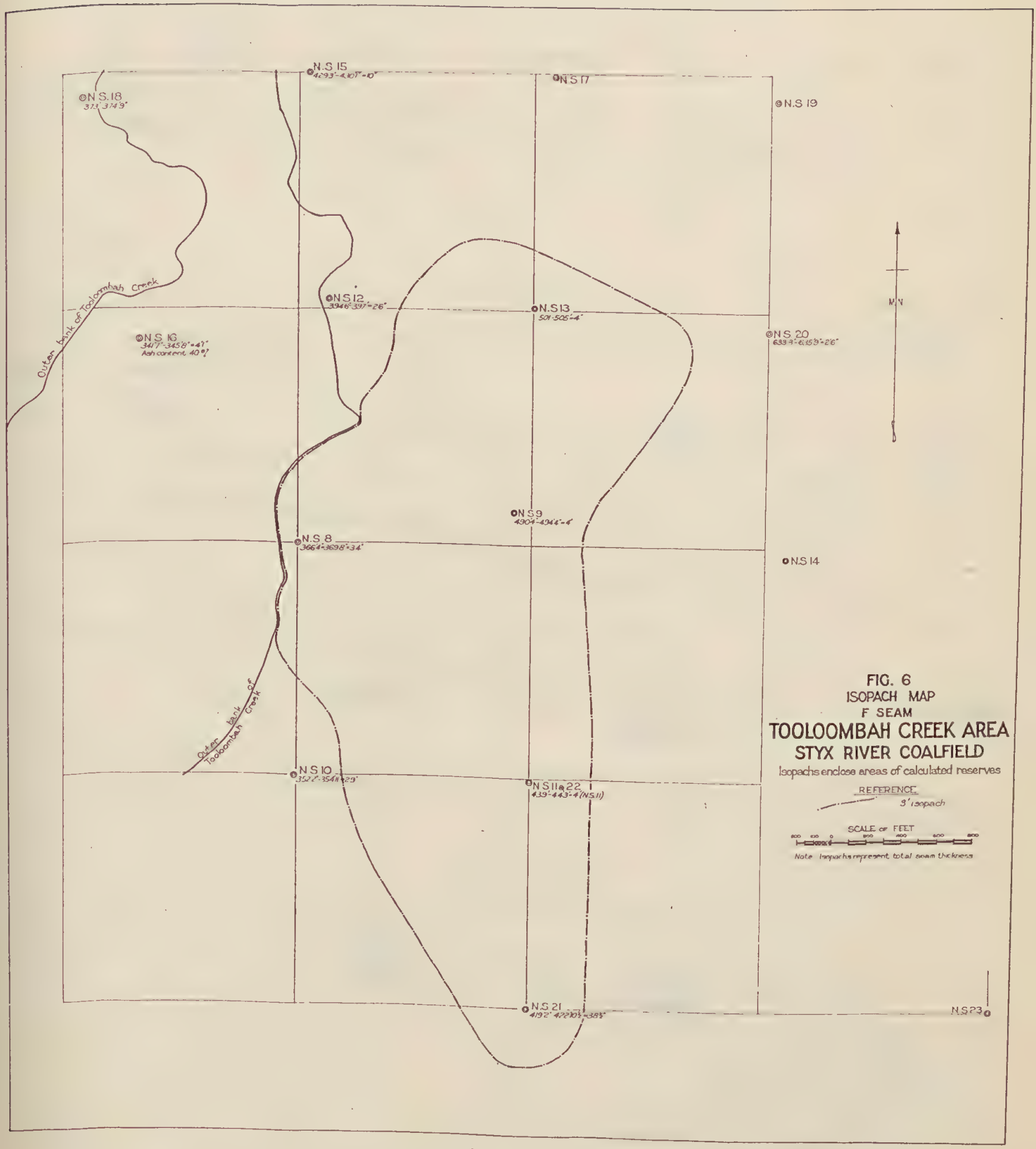
REFERENCE

3' isopach

4' isopach

SCALE OF FEET

Note: Isopachs represent total seam thickness


N.S 15
4293'-4307'-10"
N.S 17
N.S 19
N.S.18
313'-374'9"
Outer bank of Tooloombah Creek
N.S 12
3946'-397'-26"
N.S 13
501-505'-4"
N.S 16
341'7"-345'8"-41"
Ash content 40%
N.S 20
6339'-6359'-26"
N.S 9
4904'-4914'-4"
N.S 8
3664'-3698'-34'
N.S 14
Outer bank of Tooloombah Creek
N.S 10
352'-354'11"-29'
N.S 11 & 22
439'-443'-4'(N.S 11)
N.S 21
419'2"-422'10½"-38½"
N.S 23
M.N
FIG. 6
ISOPACH MAP
F SEAM
TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD
Isopachs enclose areas of calculated reserves
REFERENCE
3' Isopach
SCALE OF FEET
800 400 0 800 1600 2400 3200
Note Isopachs represent total seam thickness

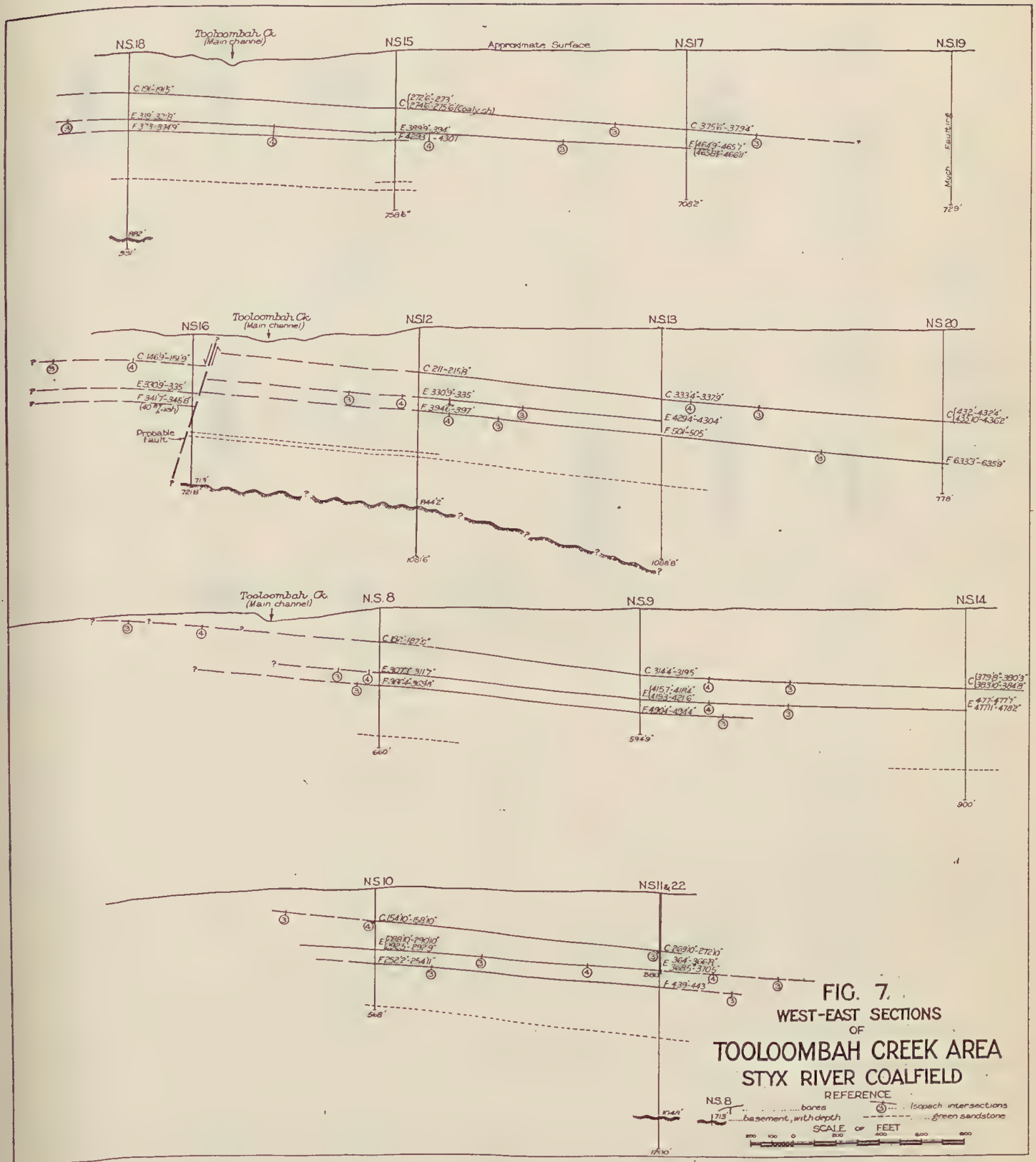


FIG. 7.

WEST-EAST SECTIONS
OF
TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD

REFERENCE

N.S.8 ..... bores

713' ..... basement, with depth

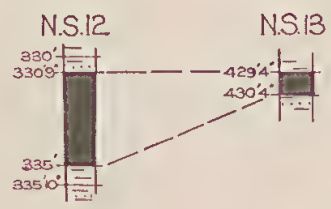
③ ..... Isopach intersections

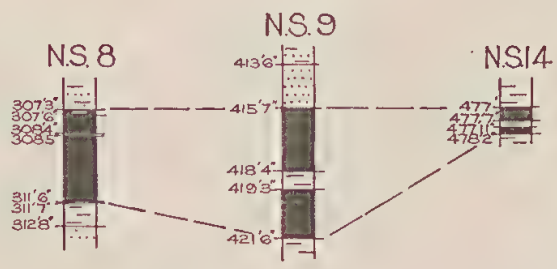
..... Green sandstone

SCALE OF FEET

200 100 0 200 400 600 800

"E" SEAM





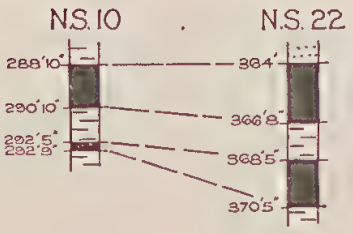
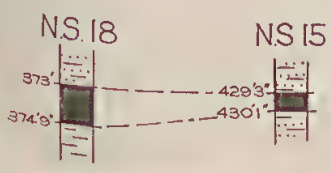
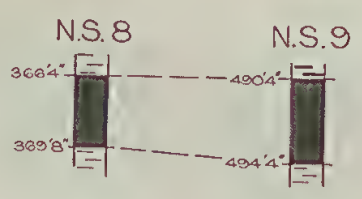
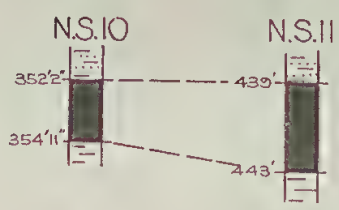


FIG. 9

"F" SEAM







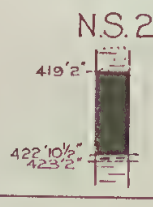
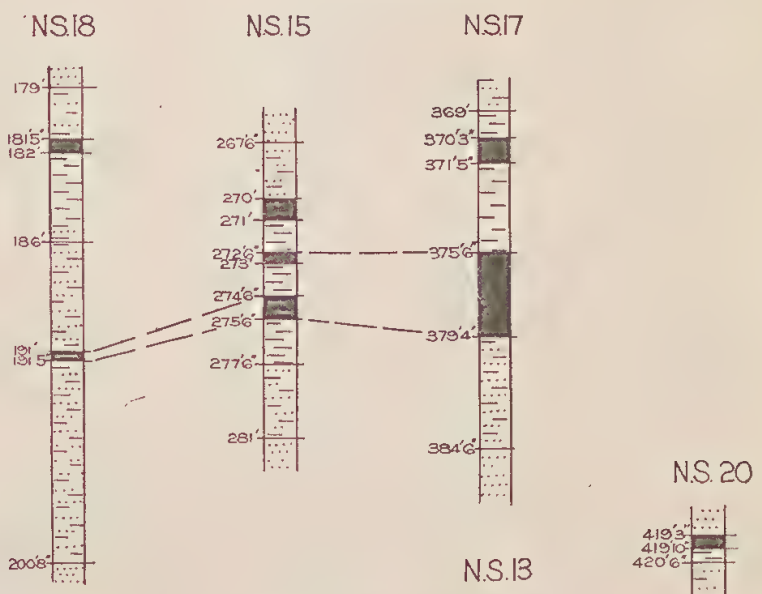
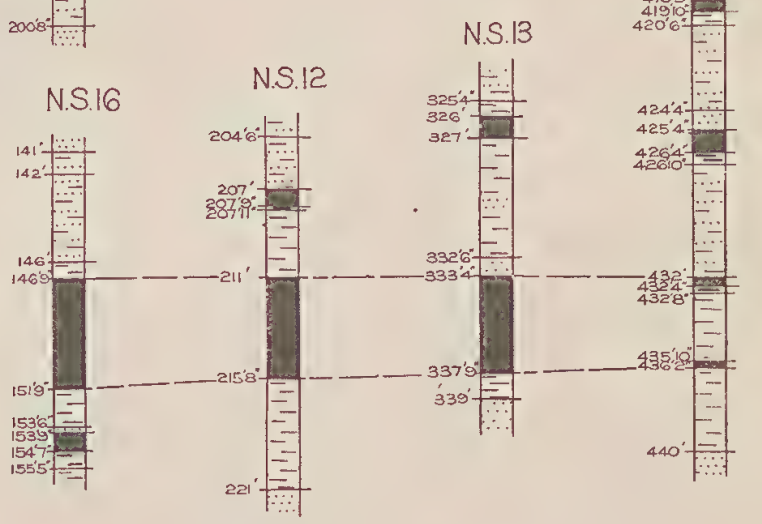
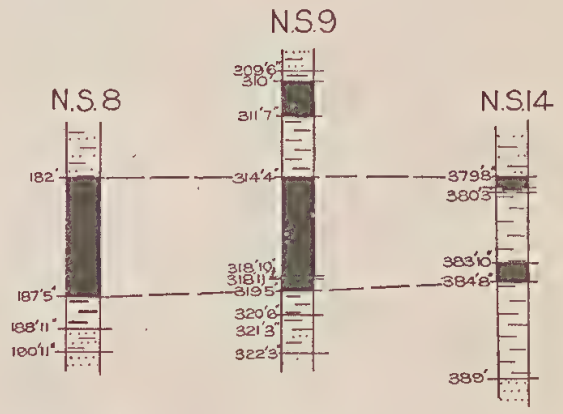


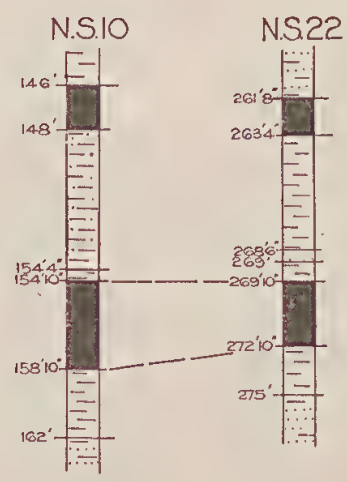
FIG. 10

"C" SEAM









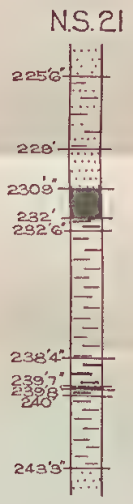


FIG. 8

FIGS. 8,9 & 10
WEST-EAST SECTIONS
"C", "E" AND "F" SEAMS
TOOLOOMBAH CREEK AREA
STYX RIVER COALFIELD

Drawn at the Dept of Mines, Brisbane. 6/5/54

SCALE OF FEET
5 0 5 10 15

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(C. C. Morton, M.C., A.C.T.S.M., Chief Government Geologist)

PUBLICATION No. 282

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

Part 3. P.D.T.S. No. 17 Mine Area, Haighmoor

Part 4. P.D.T.S. No. 16 Mine Area, Abermain

By

A. K. DENMEAD, M.Sc.,
Assistant Chief Government Geologist

BRISBANE
By Authority: A. H. Tucker, Government Printer
1955

PART 3. P.D.T.S. No. 17 MINE AREA, HAIGMOOR.

SUMMARY.

«»

As recommended by Messrs. Powell Duffryn Technical Services Ltd. the drilling programme in No. 17 Mine Area which is based on Haighmoor Extended Colliery involved the boring of six holes. This report by Mr. A. K. Denmead, Assistant Chief Government Geologist, sets out the result of a considerably augmented diamond drilling programme. Including an old borehole (N.S. 8) sixteen holes were bored, involving 9,583 ft. of drilling. In the hope of establishing an additional mine area to the east of Haighmoor Extended Colliery several additional holes were drilled in that direction, while three holes were drilled to the west of the colliery workings where it was planned to extend mining operations.

In addition to proving useful reserves in the Haighmoor top and bottom seams the drilling established the existence of two higher seams in the south-west corner of the bored area which give promise of containing useful reserves beyond its limits.

The two Haighmoor seams which are both being currently worked in Haighmoor Extended Colliery and are tentatively regarded as being split sections of the Fiery Seam, as disclosed by the boring are usually from 10 to 40 ft. apart.

The quality of the coal generally was not up to expectations and it is apparent that it will all need cleaning before being marketed. In view of the high ash content of the coal as revealed by analyses of the cores, the previously adopted practice of excluding from reserves all coal that showed an ash content in excess of 30 per cent. was modified and reserves were calculated in two categories, viz., (1) coal with ash content not exceeding 30 per cent., and (2) coal with ash content not exceeding 35 per cent. Washability tests showed that in the case of coals with 30 to 35 per cent. ash, rejection of the fraction having a specific gravity higher than 1·6 (which as a rule amounted to one-third or more of the sample) would give a product having an ash content of less than 20 per cent. It is probable that by raising the specific gravity cut off to 1·8 the washed product would still be marketable and a considerably greater proportion of the coal would be retained.

Measured reserves in the Haighmoor top seam with maximum ash content of 30 per cent, are embraced in an area of 207 acres and are estimated at 2,390,000 tons (average thickness 6 ft. 4 in.); with maximum ash content of 35 per cent. the area is increased to 249 acres and reserves to 2,570,000 tons. In the bottom seam measured reserves with maximum ash of 30 per cent. are very small and could not be estimated; with maximum ash of 35 per cent. measured reserves are 3,230,000 tons in an area of 270 acres (average thickness 6 ft. 7 in.).

There are prospects of substantial reserves in the bottom seam to the south of the bored area and also in the (?) Tantivy Seam and in an unnamed seam both of which overlie the Haighmoor seams.

Introduction.

The following report setting out the results of a diamond drilling campaign conducted by the Mines Department in and about the mine area designated No. 17 by Messrs. Powell Duffryn Technical Services Ltd. and based on the existing Haighmoor Extended Colliery is the result of a co-operative effort by Messrs. J. O. Cuthbert, Geologist, and A. McKenzie, Assistant Geologist, and the writer. The detailed geological mapping, based on pre-existing maps by the late W. E. Cameron and the writer, is largely the work of J. O. Cuthbert.

No. 17 Mine Area is the sixth to be drilled by the Mines Department, previous areas being 1, 2 and 3 (Swanbank Lagoon) and 7 and 8 (Bundamba). Three plants were employed for most of the time, namely, the Failing 2,500, the Sullivan 200A and the Sullivan 37. Some preliminary drilling was done with the Mindrill E 1000. One hole, N.S. 8 (1947), had previously been drilled. The campaign proper commenced in July, 1952, and, except for a scout hole (N.S. 67), was completed in February, 1953. Including N.S. 8 and N.S. 67 the number of holes drilled was 16 and aggregate depth drilled was 9,583 ft. Depths of holes varied from 289 ft. (N.S. 57) to 1,041 ft. (N.S. 56).

The programme proposed by Powell Duffryn Technical Services Limited involved the drilling of six holes, including one long-term hole (T. 7). During the period between the planning of the programme and the commencement of drilling the mine workings made considerable advances and this necessitated a modification of the bore-site layout. During the progress of the drilling the Coal Board, after consultation with the Geological Survey, decided to investigate the possibility of proving an additional mine area and to this end several holes were drilled east of No. 17 area. Subsequently, following upon an agreement with Messrs. Rylance Collieries and Brickworks Pty. Ltd. under which the proprietors of Haighmoor Extended Colliery were given the right to work the coal in portions 36, 37, 38, 46 and 47, parish of Chuwar, three holes were bored west of No. 17 Area.

This report is accompanied by—

(1) A map showing P.D.T.S. Mine Area No. 17, survey grid, bore locations, surface contours and surface geology.

(2) A map showing P.D.T.S. Mine Area No. 17, survey grid, bore locations, underground workings (with sample locations) and areas within which reserves have been calculated.

(3) A locality map.

(4) A sheet showing cross sections (four in number).

(5) Generalised bore sections.

(6) Diagrams showing detailed seam sections in boreholes, core recoveries, and sampling and analytical data.

(7) Diagrams showing detailed seam sections in Haighmoor Extended Colliery with analytical data.

(8) Skeleton plans showing structure contours on the Haighmoor top and bottom seams.

Geological Features.

Geological formations of Triassic, Tertiary and Recent age are represented in the area.

Alluvium.—Associated with the flood plain of the Bremer River there are loams, clays, sands and gravels that are but loosely consolidated. The greatest thickness of alluvium penetrated by the drills was 68 ft. (in N.S. 8), the base of the formation being 20 ft. below sea level. South of the Bremer River it was not easy to decide where the alluvium ended and the Tertiary formation began. For this reason no boundary has been drawn between the two formations. North of the river the alluvium masks the junction of the Tertiary beds and the coal measures. The only boundary that could be fixed was the alluvium-coal measure boundary, but even here owing to poor exposures the mapping is to be regarded as only approximate.

Tertiary.—Basalt and sediments of Tertiary age occupy a wide area between Bundamba and Ipswich. The northern boundary of the Tertiary formations lies within the bored area where it follows roughly the course of the Bremer River.

The basalt seen outcropping on the road between portions 144 and 146, parish of Goodna, does not reach the bored area. It overlies the Tertiary sediments penetrated in the boreholes. The Tertiary sediments comprise soft mudstone and siltstone, usually light grey in colour, and soft, fine-grained argillaceous sandstone towards the base of the formation. There are a few bands of lenticular clay ironstone up to 6 in. thick. A few fragments of carbonised dicotyledonous leaves were seen in the shale.

The greatest thickness of Tertiary strata penetrated was 355 ft. (in N.S. 49). The underlying coal measures were always found to be weathered at the old pre-Tertiary surface, and sometimes for considerable depths (30 ft. in one hole) below that surface. Actually the junction of the two formations is ill-defined and it was in most cases impossible to tell where one finished and the other began. In this area the destruction of coal resulting from pre-Tertiary erosion is quite unimportant, owing largely to the fact that the pre-Tertiary land surface is virtually a dip slope.

Ipswich Coal Measures.—Besides the Haighmoor top and bottom seams which the campaign was primarily designed to test three overlying seams were penetrated by the deeper holes. One hole, N.S. 56, was drilled to a depth of 804 ft. below the Haighmoor bottom seam, but failed to disclose any additional workable seams, the only coal of any consequence being some 40 ft. of coaly measures between 900 and 1,000 ft. depth. Generally speaking the shale here is rather more ferruginous than in the Bundamba area, due to the presence of dispersed iron carbonate, while the thicker sandstone sections are always rather coarse and often pebbly and contain a notable proportion of milky white fresh felspar. Calcium carbonate, in the form of thin laminae or impregnations in siltstone and occasionally in sandstone, is of frequent occurrence.

The beds here have a general east-west strike, though there are many departures from this direction. The average dip is about 8 degrees southerly. A noteworthy feature of the geological map is the convergence of strikes on either side of an easterly-flowing watercourse a few chains north of the pithead. No reasonable explanation of this phenomenon has presented itself. Two converging faults were met with in the eastern section of Haighmoor Extended Colliery. The strata show considerable disturbance between the faults, but the actual vertical movement is not great. The western fault appears to die out fairly quickly to the north-west of the workings, but the mapping suggests that the eastern dislocation persists for some considerable distance to the north. These are the only dislocations of any consequence seen in the workings. Two of the bores, N.S. 43 and N.S. 54, penetrated faults which appeared to be of considerable magnitude. However, in the case of N.S. 43, no great dislocation is indicated by the structure contours.

To the west of the bored area the map shows the hypothetical extension of the Boxwood Fault, the major structural dislocation of the North Ipswich area. The outcrop of this fault has not been found, being concealed beneath alluvium along Sandy Creek to the north-west and Bundamba Creek to the south-east. A comparison of the bore logs in No. 17 Mine Area with those in No. 16 (Abermain) Area leaves no room for doubting that the fault does, in fact, continue at least as far as portion 3, Goodna.

The identity of the seams being worked in Haighmoor Extended Colliery and of the seams overlying them in the bored area has not been established beyond reasonable doubt. This uncertainty is largely attributable to the rapid lateral variation of the seams and of the containing strata. It is impossible to trace for certain any bed higher in the succession than the Waterworks Seam across the Boxwood Fault.

Nevertheless the mapping strongly suggests that the two seams worked in Haighmoor Extended Colliery represent split sections of the Fiery (sometimes referred to as Cuffe's Upper) Seam. If such be the case, then the seam next overlying the Haighmoor top seam would in all probability be the Tantivy and the seam above that (destroyed throughout the area by a basaltic sill) would be the Garden. A still higher seam was penetrated in two of the most southerly holes. In some of the holes a thin coaly section was found lying from 20 to 40 ft. below the Haighmoor bottom seam. The outcrop of what is believed to be the same seam is exposed in a gully in a corresponding stratigraphic position in portion 62, Chuwar. This section may represent the Waterstown Seam.

Two seams that have been tentatively correlated with the Tivoli and Eclipse Seams have been traced for some distance east from their outcrops on the east bank of Sandy Creek and they have been found to deteriorate rapidly in this direction. They were not present in either of the two holes (N.S. 8 and N.S. 56) that were drilled sufficiently deep to intersect them.

The identity of the thick banded coal section penetrated in N.S. 56 some 700 ft. below the Haighmoor bottom seam is doubtful. It may be an unworked seam known as Morris' or, less probably, the Waterworks Seam. Brief descriptions of the various seams encountered in the course of the drilling follow.

Unnamed Seam above (?) Garden Seam.—This seam was penetrated in two bores, N.S. 47 and N.S. 48. It lies some 360 ft. above the Haighmoor top seam. Its outcrop has not been recognised. It may possibly be identical with a seam lying some 270 ft. above the Haighmoor top seam and apparently worked to some extent, but more probably the latter is to be correlated with the (?) Garden Seam. In N.S. 47 the total thickness of the seam was 12 ft. with a near-workable section of 4 ft. 9 in. In N.S. 48 the total thickness was 20 ft. and possibly more (as Tertiary sediments were resting directly on the weathered coal). A section of the seam 5 ft. 9 in. thick which was considered possibly workable gave an ash yield of 25·7 per cent. (core recovery 65·2 per cent.). No measured reserves were proved by the drilling, but it is possible that worthwhile reserves may exist to the south of the bored area.

(?) *Garden Seam.*—Lying between 142 ft. and 229 ft. above the Haighmoor top seam there is a basaltic sill associated with baked carbonaceous shale and coked coal. Undoubtedly this sill has been intruded along a coal seam which it has completely destroyed. In our tentative scheme of correlations this would most probably be the Garden Seam. There are, of course, no reserves in this seam. There is little doubt that the sill persists along a single horizon throughout the bored area. The greatest thickness of sill rock penetrated was 10 ft. 3 in. (in borehole No. N.S. 45).

(?) *Tantivy Seam.*—This is the seam next above the Haighmoor top seam. It exists as a workable seam only in the south-west corner of the bored area. Elsewhere it either was non-existent or it occurred as a succession of coal and stone bands with no possibly workable section. In bores Nos. 48 and 49 it appeared to be split into two sections. In the latter the bottom split appeared to have joined the

Haighmoor top seam, giving a carbonaceous section 20 ft. thick, which, however, did not include any workable coal.

In N.S. 47 the (?) Tantivy Seam showed a section 4 ft. 0¾ in. thick with an ash content of 26·0 per cent. The section in the adjacent hole, N.S. 46, was 4 ft. 5½ in. thick and had an ash content of 24·8 per cent. A seam which has tentatively been correlated with the (?) Tantivy Seam in N.S. 55 had a thickness of 5 ft. 2 in. and an ash content of 34·1 per cent.

It is not possible to give any figure for measured reserves in the (?) Tantivy Seam, but it is certain that there is a limited area of workable coal underlying portions 1, 2 and 3, parish of Ipswich, and probably also portions 1 and 36, parish of Chuwar. This coal could be worked by drifting up from the workings on the Haighmoor top seam.

The Haighmoor Seams (*(?) Fiery Seam*).—Two seams are being worked concurrently in Haighmoor Extended Colliery. Their identity has not been established beyond question, but in the opinion of the Geological Survey and of the colliery proprietors the two seams represent split sections of the Fiery Seam.

The top seam is on the average about 9 ft. thick and it includes a large number of stone bands (up to 7 in. in thickness but usually less than 2 in.). In places the seam has a sandstone roof; elsewhere the coal is separated from the sandstone by shale or the sandstone may be non-existent as in the eastern part of the bored area.

Immediately under the top seam there are, in the vicinity of the air shaft, some 16 ft. of siltstone and fine sandstone and under that 6 ft. or so of stone and coal bands (the "roof measures"). The bottom seam proper is usually between 6 and 7 ft. thick. It includes two "badgers" as well as a number of shale bands which are usually less than 2 in. thick. The boring showed that the stratigraphic distance between the top and bottom seams varies from 10 ft. to over 40 ft. Where the seams come close together the strata between them are usually more or less carbonaceous.

Neither of the Haighmoor seams extended in a workable condition over the whole of the bored area. Both seams deteriorate to the west of the Haighmoor workings. Thus in the air shaft in portion 36 the top seam was only 2 ft. 9 in. thick, the bottom 6 ft. or so having disappeared altogether. The quality of the coal in the bottom seam also is reported to have shown a marked deterioration in this shaft. The top seam was workable in both N.S. 53 and N.S. 56 some 16 chains east of the mine workings. In N.S. 67 some 25 chains east of N.S. 56 it did not have a possibly workable section, though it was workable in N.S. 51 some 20 chains easterly from N.S. 53. However, in N.S. 50 20 chains further to the east it was not workable, being represented perhaps by a band of coal only 1 ft. 2½ in. thick at 420 ft.

Like the top seam the bottom seam deteriorates fairly rapidly both east and west of the mine workings. In both N.S. 56 and N.S. 53 (to the east) it showed a marked decrease in overall thickness and quality by comparison with the sections in the nearest workings. It was represented only by bands of carbonaceous shale in N.S. 67 and N.S. 50. In N.S. 57 to the west of the colliery there was a section over 10 ft. thick which has been tentatively correlated with the Haighmoor bottom seam. The quality of the coal was mostly very inferior, only the bottom 3 ft. 8½ in. being of possibly workable grade (ash 33·7 per cent.).

To the south (*i.e.*, to the dip) the bottom seam showed a good deal of variation in quality and thickness but in the three deepest holes it showed considerable improvement particularly in N.S. 49 where it was over 8 ft. thick and of workable quality. It is apparent that the limits of workability in the bottom seam lie beyond (south of) the most southerly line of holes.

Description of the Coal.—While no petrological study has been made of the Haighmoor seams, the coal macroscopically is similar to such of the Tivoli coals whose petrological characters are known. The coal is bright and friable, particularly where of good quality. The coal has the characteristic sub-cubical fracture which readily distinguishes the coals of North Ipswich from the Bundamba coals. In consequence of the extreme friability of the best of the coal the cores as recovered were often in a finely broken condition and it is probable that some of the finely divided material would have been carried away in the drilling mud. For this reason the reported ash values are likely to be higher than the true values.

Fixed carbon on a dry mineral-free coal basis varies from 61·4 per cent. to 66·8 per cent. and averages about 64 per cent. This places the coal in the high volatile bituminous group. Moisture is usually about 1·2 per cent. Sulphur in most samples ranged from 0·3 per cent. to 0·33 per cent. Calorific value for coal carrying 25 per cent. ash would be about 11,000 B.T.U. per lb.

Washability tests carried out on selected samples showed that for coals having an ash value of between 30 and 35 per cent. the fraction having a specific gravity not exceeding 1·6 would constitute from 67 per cent. to 55 per cent. of the whole and would contain from 10 per cent. to 17 per cent. ash. If, however, the specific gravity cut-off were increased to 1·8, thereby including a much larger percentage of the sample, it is probable that the product would still in most cases constitute a marketable coal. After consultation with the Coal Board it has been decided that future washability tests will be carried out with specific gravity cut-offs 1·4, 1·6 and 1·8.

The coal is strongly coking. A sample from Haighmoor Extended Colliery taken in 1953 by the Coal Board gave an agglutinating value of 26 and a swelling index of 8½.

TABLE 1.

TABLE OF WASHABILITIES.

Seam.	Unnamed.	(?) Tantivy.	(?) Tantivy.	H. Top Top Sect.	H. Top Bott. Sect.	H. Top	H. Top	H. Top	H. Top
Bore Number.	N.S. 47	N.S. 46	N.S. 55	N.S. 45	N.S. 45	N.S. 46	N.S. 47	N.S. 51	N.S. 53
G.S. Number.	551/52	467/52	12/53	548/52	549/52	468/52	472/52	564/52	565/52
Ash.	32·0%	24·8%	34·1%	32·2%	44·2%	28·7%	33·9%	23·1%	25·6%
	%	%	%	%	%	%	%	%	%
Floats Sp. Gr. 1·4 ..	51·5	58·6	38·6	27·6	33·9	47·6	47·8	64·5	57·9
Ash	9·1	8·7	11·6	13·7	10·6	6·6	7·4	7·1	8·4
Floats Sp. Gr. 1·5 ..	9·1	10·3	12·0	20·7	8·5	9·5	5·9	6·5	7·9
Ash	29·4	24·1	24·2	22·7	21·1	24·8	21·8	26·0	20·4
Floats Sp. Gr. 1·6 ..	6·0	6·9	6·0	6·9	5·1	7·2	4·5	3·2	5·3
Ash	31·2	33·9	30·7	29·4	26·8	29·8	28·4	27·6	27·9
Sinks Sp. Gr. 1·6	33·3	24·2	43·4	44·8	52·5	35·7	41·8	25·8	28·9
Ash	63·9	60·3	58·0	51·0	69·1	61·9	66·0	60·1	74·4

Seam.	H. Bott.	H. Bott.	H. Bott.	H. Bott. Top Sect.	H. Bott. Bott. Sect.	H. Bott. Top Sect.	H. Bott. Bott. Sect.	H. Bott.	H. Bott.
Bore Number.	N.S. 45	N.S. 46	N.S. 47	N.S. 48	N.S. 48	N.S. 49	N.S. 49	N.S. 53	N.S. 57
G.S. Number.	550/52	469/52	552/52	476/52	447/52	562/52	563/52	11/53	13/53
Ash.	44·9%	27·2%	30·9%	32·5%	32·1%	29·4%	25·0%	32·7%	41·9%
	%	%	%	%	%	%	%	%	%
Floats Sp. Gr. 1·4 ..	21·4	53·5	54·2	40·0	50·0	44·5	58·9	32·7	32·5
Ash	11·4	6·0	6·7	8·9	7·7	9·1	10·8	11·7	8·9
Floats Sp. Gr. 1·5 ..	10·7	9·3	8·3	12·5	6·5	13·3	11·7	13·5	7·3
Ash	23·8	22·3	22·5	25·4	25·2	20·9	20·8	22·9	24·0
Floats Sp. Gr. 1·6 ..	10·7	4·6	4·2	7·5	8·7	8·9	5·9	7·7	2·6
Ash	30·8	28·3	27·9	34·0	26·6	28·0	22·5	30·0	31·8
Sinks Sp. Gr. 1·6 ..	57·2	32·6	33·3	40·0	34·8	33·3	23·5	46·1	57·6
Ash	60·2	63·5	64·3	56·5	60·1	56·0	53·9	55·6	59·4

Table 1 sets out the results of washability tests carried out by the Government Analyst on selected samples from the Haighmoor area.

Reserves.

In the bored area reserves are almost wholly limited to the two Haighmoor seams. An unnamed seam lying some 360 ft. above the Haighmoor top seam was penetrated in two bores in the south-west corner of the bored area (it was eroded in all other holes). No reserves have been proved in this seam but there are prospects of considerable reserves south of the bored area. The (?) Tantivy Seam likewise showed promise in the south-west corner of the area where two adjacent boreholes gave workable sections. There are no measured reserves but there are prospects of an extension of workable coal in the country south of the bored area.

In previous reports on diamond drilling of mine areas on the Ipswich Field it has been the practice to disregard any section having an ash content greater than 30 per cent. for the purpose of estimating reserves. However, in this case the ash in the run-of-mine coal from Haighmoor Extended Colliery actually exceeds this figure and it would be unrealistic to ignore the fact. After discussion with the Coal Board it has been agreed that reserves should be calculated in two categories, viz. (1) with maximum ash content of 30 per cent; (2) with maximum ash content of 35 per cent. It is intended to adhere to this practice in estimating reserves throughout the North Ipswich mining district.

Owing to the broken nature of the cores and also to the lenticularity both of the coal plies and the shale bands it was in many cases impossible to recognise the section worked in the mine. Hence the sampled sections may not be identical with the worked section. Both seams are extremely variable both as to total thickness and as to their ash content.

Generally, in sampling, stone bands were not excluded. Only in four cases was any stone excluded and in these cases it was considered that the bands would be rejected in actual mining. In mine sampling, samples were taken (1) including the major bands and (2) excluding the major bands. For the purposes of estimating reserves the mine samples which included the stone bands were used, as it is not the practice to remove the bands underground. Unless there was reason to believe otherwise "measured reserves" include coal 5 chains beyond the extreme points of observation.

Haigmoor Top Seam.—The area within which the ash does not exceed 30 per cent. is approximately 207 acres. Average thickness, based on mine and borehole measurements is 6 ft. 4 in. and average weighed ash value is 26·8 per cent. Measured reserves, based on an average specific gravity of 1·488 amount to 2,390,000 tons. Measured reserves of coal with maximum ash value not exceeding 35 per cent. are estimated at 2,570,000 tons. In this category, average seam thickness is 5 ft. 8 in., average ash is 28·3 per cent. and average specific gravity is 1·502. These reserves are embraced within an area of approximately 249 acres.

Haighmoor Bottom Seam.—Ash value of samples taken from this seam were less than 30 per cent. in only two bores and reserves in this category have not been estimated. The area of coal having an ash content not exceeding 35 per cent. is approximately 270 acres. Average ash is 31·4 per cent. and average thickness is 6 ft. 7 in. Measured reserves based on an average specific gravity of 1·537 are estimated at 3,230,000 tons. Total measured reserves in Haighmoor top and bottom seams are 5,800,000 tons. The maximum vertical depth of coal included in the above estimate does not exceed 800 ft.

30th November, 1954.

DEPARTMENT OF MINES, QUEENSLAND

GEOLOGICAL MAP

P.D.T.S. No. 17 MINE AREA

HAIGHMOOR

IPSWICH COALFIELD

County of Stanley · Parishes of Chuwar & Goodna.

Showing geology, topography & boreholes

To accompany report by A.K.Denmead, M.Sc.

Geology by J.O.Cuthbert, B.Sc.

Topographical Survey by D.Michael & E.Cowley.

Scale of Chains

4 2 0 4 8 12

Twenty chain grid on True North. Elevations in feet on State Datum.

LEGEND

Established geological boundary - position accurate
- position approx.
Inferred, probable or indefinite boundary
Established fault - position accurate
- position approx.
- concealed
Inferred, probable or indefinite fault
Inferred, probable or indefinite fault, concealed
High angle fault — D — Colliery (Working) — HAIGHMOOR
Ipswich Coal Measures — Colliery (Abandoned) — NOBLE VALE ADIT
Alluvium — Adit
Coal Seam at Surface — Shaft
Outcrop — Diamond Drillhole — N.S.61
Strike & dip of strata — 12S — Percussion Drillhole — Bore 11 (P)
Strike & dip of joints — 75 — Surface Contours — 60

N. English, Del.

PARISH OF CHUWAR

PARISH OF IPSWICH

PARISH OF GOODNA

R.298

ECLIPSE

TIVOLI

WATERSTOWN

HAIGHMOOR

HAIGHMOOR EXTD. No.II

OLD ADIT

OLD TRIAL ADIT (Collapsed)

BELL ADIT(A)

OLD ADITS (Collapsed)

JUNCTION

ROAD

Dam

Air Shaft

Coal Loading Wharf

BREMER R.

Ck.

Sandy Ck.

Bundamba Ck.

Probable extension of Boxwood Fault

I—MINE AREA

Alluvium

Alluvium overlying Ipswich

Alluvium overlying Tertiary

Ipswich boundary obscured by alluvium

Bore (P) RL 53·43

Bore (P) RL 52·73

Bore (P) RL 46·01

Bore (P) RL 47·37

Bore 4(P) RL 46·60

Bore (P) RL 44·39

Bore (P) RL 44·85

Bore 5(P) RL 46·74

Bore 11(P) RL 46·40

Bore 7(P) RL 46·80

Bore 6(P) RL 45·00

Bore 8(P) RL 45·40

Bore 15(P) RL 50·06

Bore 16(P) RL 39·87

Bore 19(P) RL 52·04

Bore 13(P) RL 51·64

Bore 17(P) RL 46·75

Bore 20(P) RL 17·55

Bore 21(P) RL 37·57

Bore 22(P) RL 51·45

N.S.54 RL Col. 70·63 RL Surf. 67·39 RL Btm. -242·04

N.S.55 RL Col. 44·36 RL Surf. 42·71 RL Btm. -481·89

N.S.56 RL Col. 48·30 RL Surf. 47·10 RL Btm. -992·53

N.S.57 RL Col. 69·69 RL Surf. 108·70 RL Btm. -179·72

N.S.8 RL Surf. 47·80 RL Btm. -745·20

N.S.53 RL Col. 43·15 RL Surf. 41·70 RL Btm. -827·60

N.S.46 RL Col. 41·76 RL Surf. 40·96 RL Btm. -761·16

N.S.43 RL Col. 32·73 RL Surf. 31·31 RL Btm. -667·94

N.S.45 RL Col. 46·20 RL Surf. 42·02 RL Btm. -675·55

N.S.47 RL Col. 35·93 RL Surf. 34·13 RL Btm. -740·07

N.S.48 RL Col. 48·75 RL Surf. 46·95 RL Btm. -750·67

N.S.49 RL Col. 45·91 RL Surf. 41·73 RL Btm. -852·67

N.S.51 RL Col. 36·81 RL Surf. 35·56 RL Btm. -575·86

N.S.52 RL Col. 33·59 RL Btm. -69·41

N.S.50 RL Col. 33·59 RL Surf. 32·09 RL Btm. -600·59

N.S.67 RL Col. 53·08 RL Surf. 51·50 RL Btm. -270·92

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

P.D.T.S. No 17 MINE AREA

HAIGHMOOR

IPSWICH COALFIELD

County of Stanley · Parishes of Chuwar & Goodna

Showing mine workings, topography & boreholes

To accompany report by A.K. Denmead, M.Sc.

Topographical survey by D. Michael & E. Cowley

Scale of Chains

10 5 0 5 10 15 20

Twenty chain grid on True North. Elevations in feet on State Datum

LEGEND

- Colliery (Working) — HAIGHMOOR — Workings on Top Seam
- Colliery (Abandoned) — NOBLE VALE No 1 ADIT — Workings on Bottom Seam
- Adit
- Shaft
- Diamond Drillhole — N.S.61
- Percussion Drillhole — oBore 11(P)
- Surface Contours — 60
- Stone Drive
- Fault established in Mine workings
- Boundaries of calculated reserves shown thus:
  - Top Seam. Ash not greater than 30%
  - Top Seam. Ash not greater than 35%
  - Bottom Seam. Ash not greater than 35%
- Section line A——A' — Sample taken in Mine Workings — ⊗ H.T.S 2

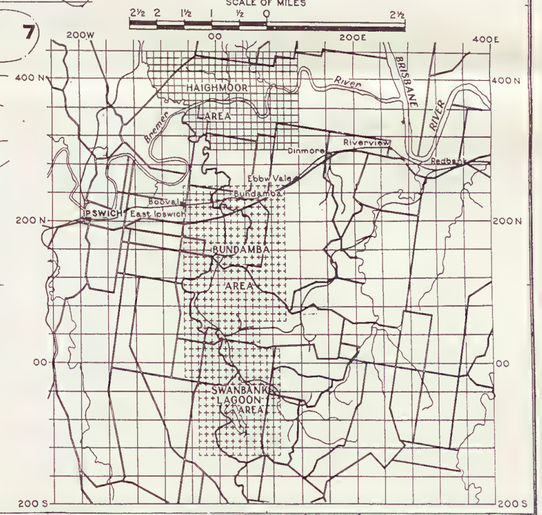
Note: Calculated reserves lie wholly outside mine perimeter

N. English, Del.

LOCALITY MAP

SCALE OF MILES

2½ 2 1½ 1 ½ 0 2½



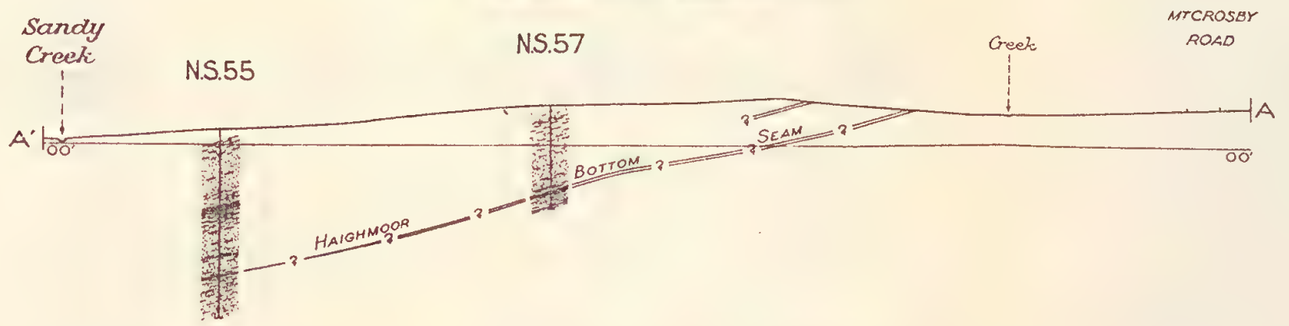
To accompany report by A.K.Denmead M.Sc.

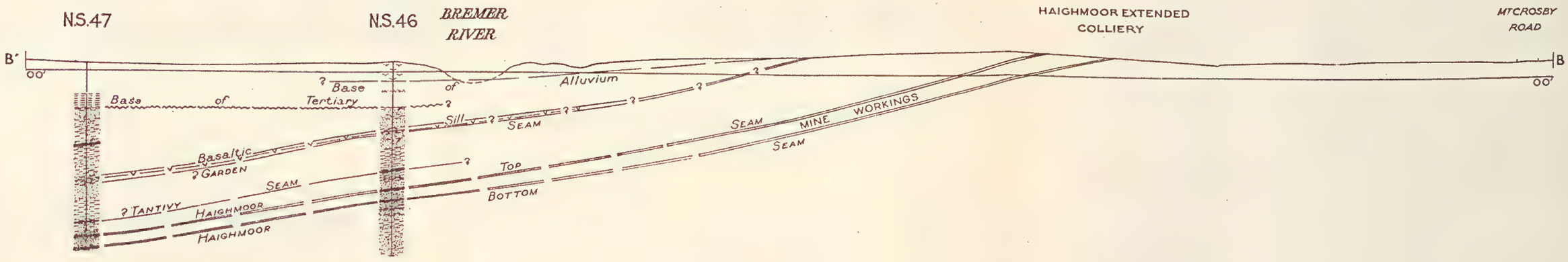
P. D. T. S. Nº17 MINE AREA

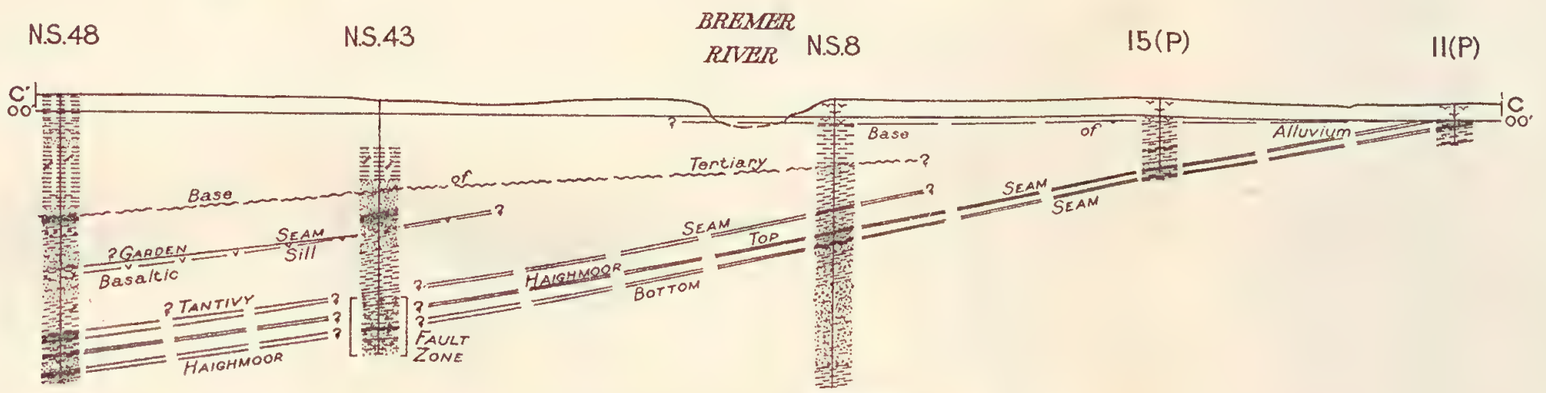
HAIGHMOOR

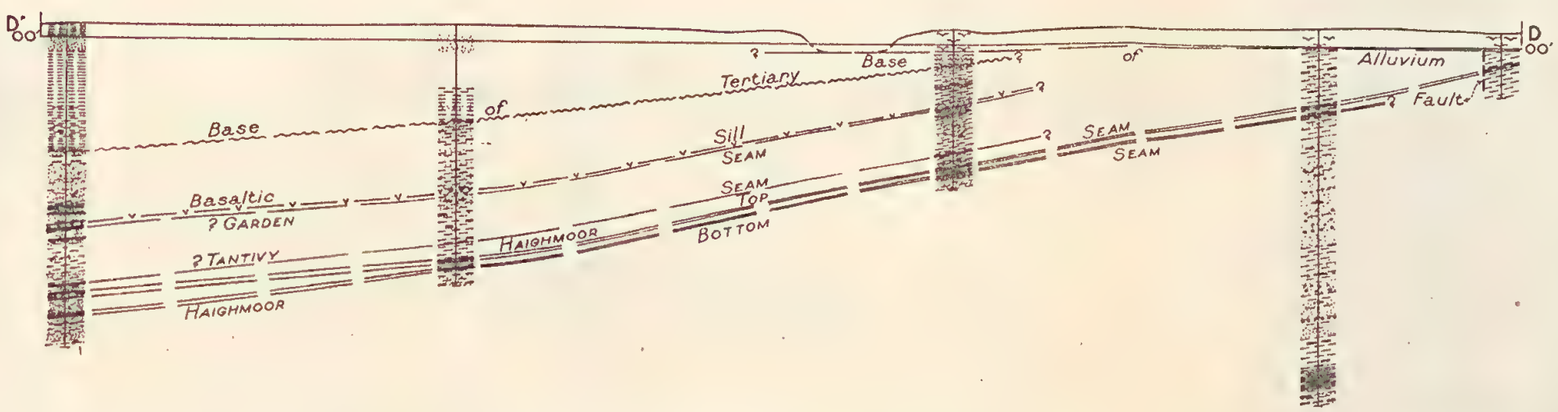
CROSS SECTIONS

Scale of Chains





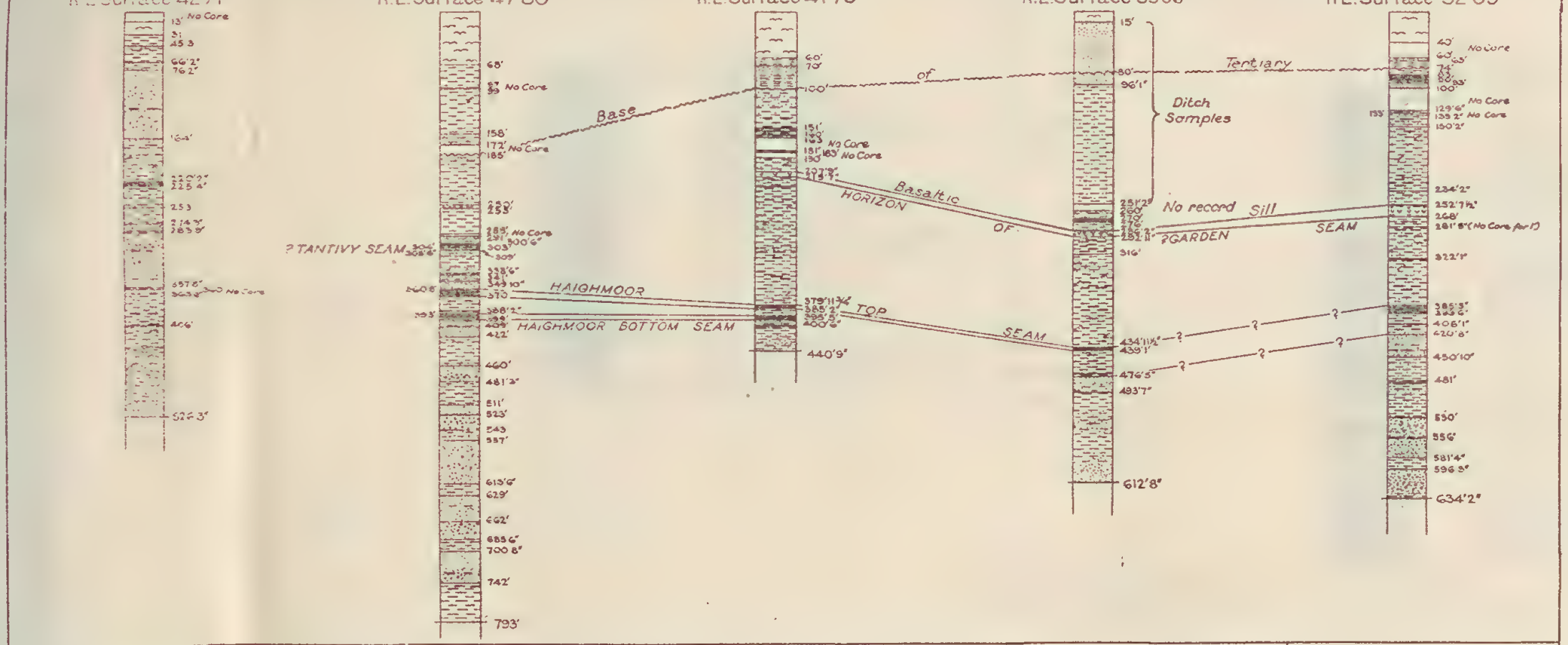


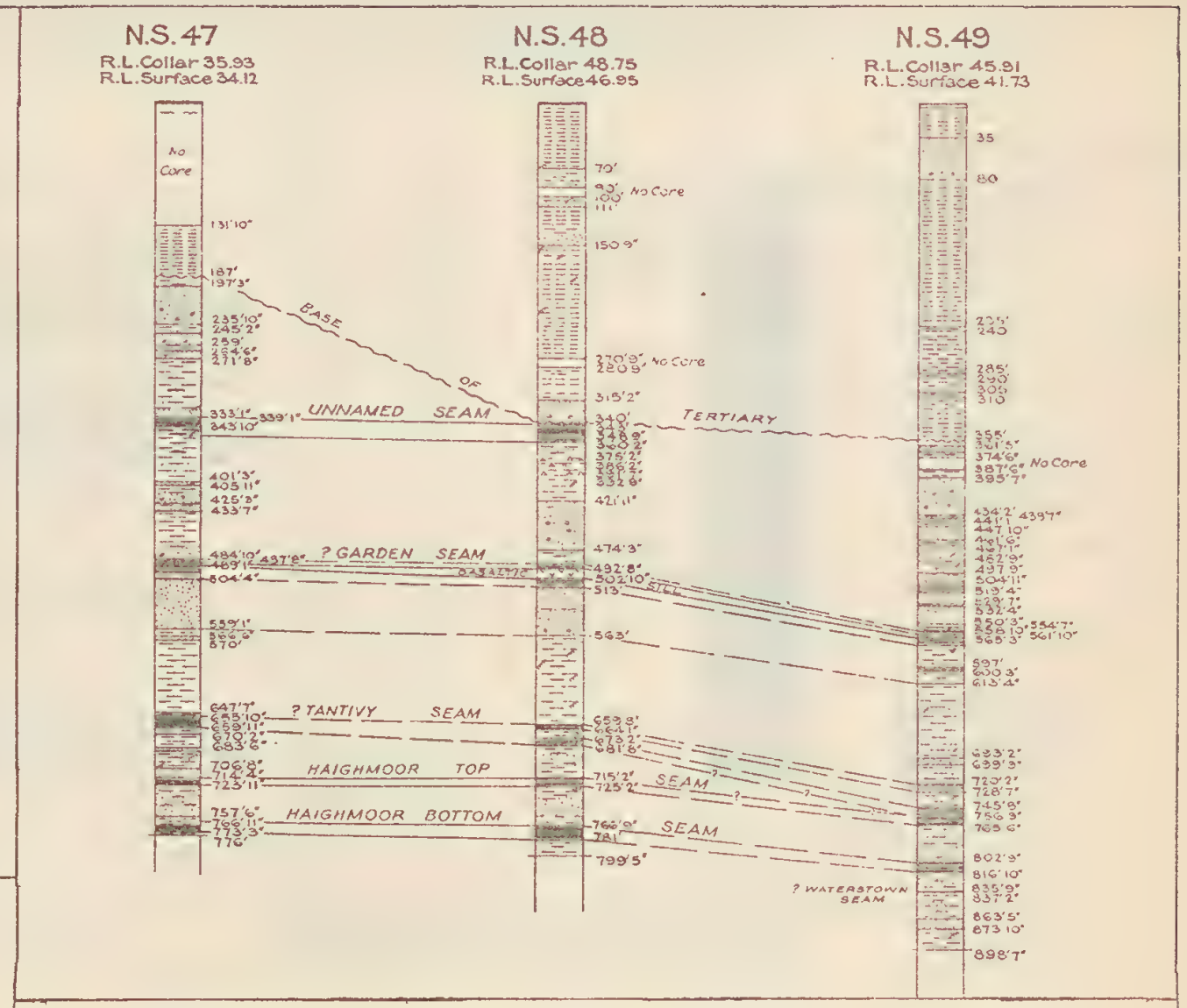


LEGEND

- Alluvium.
- Mudstone. / Claystone
- Shale
- Siltstone
- Sandstone
- Pebbly Sandstone.
- Carb. sh.
- Coal
- Iron Carb.
- Basaltic Sill
- Fault Zone

N.E. 9·12·54





P.D.T.S. Nº17 MINE AREA

HAIGHMOOR

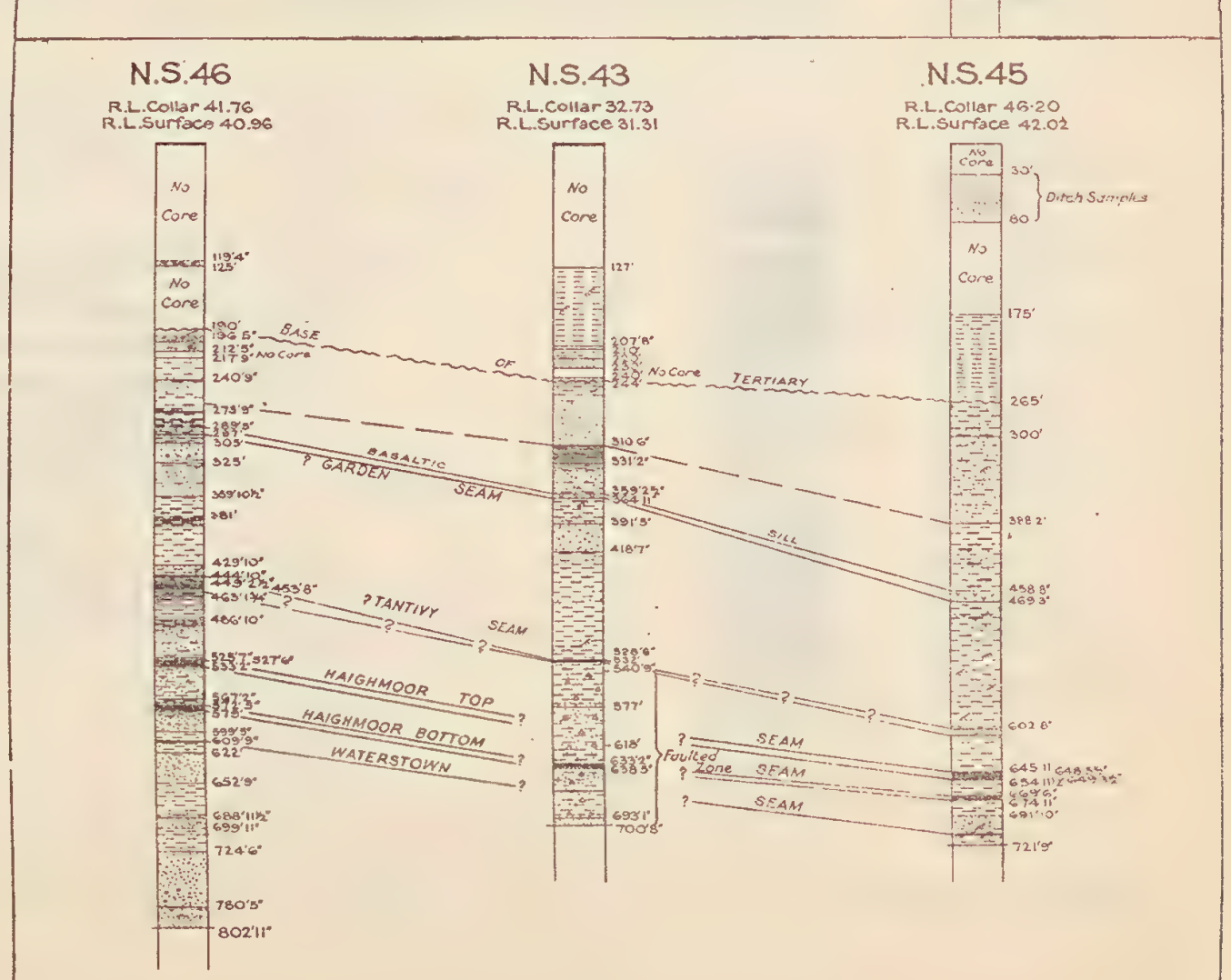
GENERALISED BORE SECTIONS

Scale of Feet.

100 50 0 100 200 300

	LEGEND	
Alluvium	Pebbly sandstone.	
Mudstone } Claystone } Shale.	Carb.sh.	
	Coal.	
Siltstone.	Iron Carb.	
Sandstone.	Basaltic Sill.	
	Fault Zone.	

To accompany report by A.K. Denmead. M.Sc.



NE 13834

P.D.T.S. No. 17 MINE AREA **HAIGHMOOR** DIAGRAMS OF HAIGHMOOR TOP SEAM DETAILS OF CORE RECOVERY AND ANALYSES

N.S.46

Proximate Analysis Recovery Section S, Cal Value & S.G. per cent Sampled	Seam Section	Description
M% 1.2 V.M.% 27.1 F.C.% 43.0 A% 28.7 99.3 S% 0.36 Joules/Gm. 24360 B.T.U./lb. 10480 S.G. 1.502	525'3" 525'7" 527'6" 528'7" 532'1" 533'2" 533'5½"	1½" inferior coal 2" dk grey sh. 4" (broken core) coal 1" dk grey sh lens. 4" (broken core) coal 1½" dk grey sh. 2" (broken core) coal ½" fawn sh band 1" coal 3½" (broken core) thin bands coal & sh 1½" inferior coal 3" dk grey sh, many coal lents 3" (broken core) coal. ⅞" thin bands sh. & coal. 6½" (broken core) coal, sh partings near bottom. (1" sh, ½" coal) 3½" (partly broken core) coal ¾" fawn sh. 8¾" (broken core) coal, few sh. partings. 1½" dk grey sh., coal lents ½" fawn sh. 5" (¾"-core) coal 9" (broken core) coal ½" sh. 1⅛" coal. ½" sh. 12" (partly broken core) coal. 5½" (broken core - except 1⅛" at top) coal. 2" coal with sh partings 1½" dk grey sh. 4" coal with sh partings. 3½" dk grey sh.

OVERALL RECOVERY 99.0%
525'3" to 533'5½"

N.S.45

Proximate Analysis Recovery Section S, Cal Value & S.G. per cent Sampled	Seam Section	Description
M% 0.9 V.M% 31.0 F.C% 35.9 A% 32.2 91.8 S% 0.30 Joules/Gm. 21540 B.T.U./lb. 9260 S.G. 1.616 A% 70 S.G 2.103 100 M% 1.2 V.M% 22.0 F.C% 32.6 A% 44.2 84.6 S% 0.21 Joules/Gm. 17990 B.T.U./lb. 7740 S.G. 1.691	645'8" 645'11" 648'2" 648'5½" 649'3½" 651'2" 654'11½" 655'2" 658'2"	½" carb. sh. 2½" buff sh. 3" coal 1'1⅝" (broken core) coal & carb. sh with coal lents 2½" coal ½" lenticular sh band 5" (partly broken core) coal, some carb. sh 1" coal. 1" buff sh with coal lents 1½" (broken core) coal. 1" buff sh with coal lents 3" dk grey sh 11" (broken core) coal, inferior coal, sh. (at least three ⅛" bands of sh.) 1⅛" buff sh grading to carb. sh 2" (broken core) coal. 1⅛" coal. ½" sh. 5⅛" (broken core) coal. 1½" dk grey sh with many coal lents 1½" dk grey sh with few coal lents 1'4" (broken core) coal 1½" coal ½" sh 1'3⅝" (broken core) coal with one 1" buff sh band near top. 2⅛" dk grey sh 2" grey sh 1'1⅛" limestone (top 4" argillaceous) ¾" dk grey sh 3" (broken core) carb. sh & coal 6" (partly broken core) sh & carb. sh 3⅛" (broken core) carb sh & coal. ½" coal 2½" carb sh & coal bands 6" dk grey sh., few coal lents

OVERALL RECOVERY 91.3%
645'8" to 658'2"

N.S.56

Proximate Analysis Recovery Section S, Cal Value & S.G. per cent Sampled	Seam Section	Description
M% 1.3 V.M% 28.0 F.C% 44.9 A% 25.8 100 S% 0.48 Joules/Gm. 25290 BTU/lb. 10880 S.G. 1.489 A% 74.3 S.G. 2.309 M% 1.4 V.M% 27.1 F.C% 47.2 A% 24.3 100 S% 0.42 Joules/Gm. 26180 BTU./lb. 11260 S.G. 1.458 A% 74.7 S.G. 2.224	206'8½" 207' 207'11½" 210' 210'3" 210'11¾" 213' 217'3½" 219' 219'4"	Roof: dk grey sh, coal lents & carb sh in backsh 2'; 1" fawn siltstone at 88' from backcom (1½" (broken core) coal, sh 5" grey sh 1½" dk grey sh, coal lents ⅜" dk grey sh, coal lents 2¾" buff sh 1½" dk grey sh 2¾" fawn sh ½" inferior coal ½" carb sh ½" inferior coal 1'5½" (mainly broken core) coal 2" fawn sh 1½" inferior coal, some broken mon. cent 3" (broken core) coal 2" (broken core) coal 1" inferior coal 8¾" fawn & dk grey sh, coal lents 5¼" (broken core) coal 6½" inferior coal 7½" (broken core) coal 1" inferior coal 3¾" dk grey sh grading to "bluey" ¼" inferior coal 1¾" inferior coal 3¼" (partly broken core) coal 1" dk grey sh coal lents 1'7½" (mainly broken core) coal, few sh lents 1" fawn sh 7¾" (partly broken core) coal 1'3½" (mainly broken core) coal, ½" shale about 3" from top 2½" dk grey sh 2" (broken core) coal ¾" coal with sh lents 10½" light grey siltstone. 1" (broken core) coal 1" dk grey sh 3½" coal with a few sh lents 1½" bluey sh ½" carb sh FLOOR. Shale

OVERALL RECOVERY 100%
206'8½" to 219'4"

NE 12 7 54

N.S.47

Proximate Analysis Recovery Section S, Cal Value & S.G. per cent Sampled	Seam Section	Description
M% 1.3 V.M% 26.4 F.C% 43.7 A% 28.6 91.2 S% 0.36 Joules/Gm 24330 B.T.U/lb 10460 S.G 1.508 M% 1.2 V.M% 26.1 F.C% 38.8 A% 33.9 85.2 S% 0.31 Joules/Gm 22420 B.T.U/lb. 9650 S.G. 1.563	714'5" 716'4" 716'9½" 718'7¾" 719'2" 722'2" 723'10¾"	1'11" (broken core) coal, some sh. 3" (broken core) coal, some sh, at least ½" buff sh 1" dk grey sh. 1⅛" boulder' 3" carb sh. 2" silts. & sh. 3" (broken core) inferior coal & sh. 1" fawn sh 4" dk grey sh. 3" (broken core) sh, coal lents 3¼" (broken core) coal, some sh 2'6½" (broken core) coal, some sh., at least one band ½" fawn sh. and one ½" dk grey sh 2½" coaly sh. 3¼" (broken core) coal, some sh. 1'8¾" (broken core) coal, some sh., at least one 1" band fawn sh. and one 1¼" dk grey sh.

OVERALL RECOVERY 91.6%
714'5" to 723'10¾"

N.S.48

Proximate Analysis Recovery Section S, Cal Value & S.G. per cent Sampled	Seam Section	Description
M% 1.0 V.M% 28.1 F.C% 40.7 A% 30.2 82.7 S% 0.32 Joules/Gm. 23760 B.T.U./lb. 10220 S.G 1.546 M% 1.3 V.M% 26.0 F.C% 43.8 A% 28.9 100 S% 0.34 Joules/Gm. 24340 B.T.U./lb. 10470 S.G. 1.508	715'2" 716' 718'5" 718'9¾" 720'5" 721'1¾" 722'5" 723'10½" 724'2" 725'2"	3½" fawn sh, coal band in middle 3½" (broken core) coal & sh. 2" fawn sh. 1'5" (broken core) coal & inferior coal 1" fawn sh 1" dk grey sh 1½" coaly sh, some nodular iron carb 2" 'boulder' 3¼" coal. 3½" (broken core) coal 1" (grey sh, nodular iron carb 1½" coal 1¼" dk grey sh ½" fawn sh 1'1" (broken core) dk grey sh, some coal ¾" (broken core) sh, some coal 3" (half core) dk grey sh. 3" (broken core) inferior coal & sh 3½" (broken core) coal, some sh 7½" (half core) coal & inferior coal. 2½" grey sh 1" dk grey sh ½" (broken core) coal, some sh 3¼" (broken core) coal & some sh. 2" shaly coal. 4" coal 3½" (broken core) coal. 1⅛" fawn sh. 1" shaly coal 6" coal ½" boulder' 3½" grey sh 2½" grey sh. ½" coal 2½" coal with two sh lents ½" coal. 1¼" sh 4" (partly broken core) sh with few coal bands

OVERALL RECOVERY 92.7%
715'2" to 725'2"

N.S.49

Proximate Analysis Recovery Section S, Cal Value & S.G. per cent Sampled	Seam Section	Description
M% - V.M% - F.C% - A% 35.5 77.7 S% - Joules/Gm. - B.T.U./lb. - S.G. - M% - V.M% - F.C% - A% 33.9 70.9 S% - Joules/Gm - B.T.U/lb - S.G. -	745'8" 746'9" 748'6" 749'4½" 751'6" 761'10" 764'1½" 765'6"	3" (broken core) coal 3" dk brown sh 1" carb sh 1'3" (partly broken core) coal, 1" 'bluey' at bottom. 2½" coaly sh 7" (broken core) inferior coal, 'bluey' 1½" sh & some sh. 1'9" dk grey siltstone & sh. 3" limestone 4" limestone 10' dk grey siltstone & sh. 8" (broken core) coal 1½" fawn sh 6½" (broken core) coal ½" dk grey sh, coal lents 3" coal 1'4½" dk. grey sh., coal lents & few bands

OVERALL RECOVERY 45.0%
745'8" to 765'6"

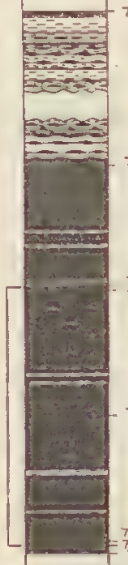
To accompany report by A.K. Denmead M.Sc.

P.D.T.S. No. 17 MINE AREA **HAIGHMOOR** DIAGRAMS OF HAIGHMOOR BOTTOM SEAM DETAILS OF CORE RECOVERY AND ANALYSES

N.S.47

Proximate Analysis S, Cal. Value & S.G.		per cent Sampled
M%	1.2	
VM%	26.4	
FC%	41.5	
A%	30.9	100
S%	0.29	
Joules/Gm.	23220	
BTU/lb	9990	
SG	1.532	

OVERALL RECOVERY 93.4%
760'3¾" to 773'3½"



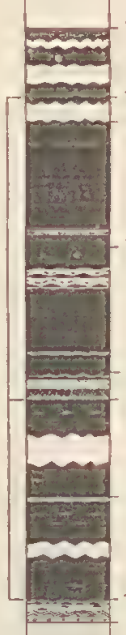
760'3¾" 1¾" coaly sh
4½" brown sh, 1" dk grey sh, ½" dk brown sh, 1" dk grey sh, ¼" coal, 1" dk brown sh.
6" coaly sh.
3¼" brown sh.
6" (partly broken core) coaly sh, coal lents
¾" dk grey sh ½" brown sh
7½" coaly sh, coal lents
764' 2" inferior coal
1'2½" inferior coal.
½" sh. (slight brecciation)
3½" coal & inferior coal
1" sh. 3" (broken core) slickensided inferior coal
1" slickensided sh.
9" inferior coal
764'11" 2½" carb sh 1" inferior coal
767'
1'10" (partly broken core) coal, few sh partings, some inferior coal.
½" sh. ½" coal (fusain) ½" coal.
1" dk grey and dk brown sh ¼" coal
¾" dk brown sh, coal lents in middle
770' 5½" (partly broken core) coal, some inferior coal in last 4¼"
1'2½" (partly broken core) coal, some inferior coal.
3" (broken core) dk grey sh with some coal top ½" bottom
9½" (broken core) coal
1" sh
8" coal with thin sh bands 1½" from top & at bottom.
773' 1½" (broken core) coal
773'1" 2½" (broken core) coal with thin sh bands.
773'3½"
FLOOR: dk grey sh.

N.S.48

Proximate Analysis S, Cal. Value & S.G.		per cent Sampled
M%	1.2	
V.M%	26.7	
F.C.%	41.7	
A%	32.5	91.4
S%	0.33	
Joules/Gm.	22740	
BTU/lb	9780	
S.G.	1.556	

M%	1.2	
V.M%	26.7	
F.C.%	40.0	
A%	32.1	76.1
S%	0.31	
Joules/Gm.	22820	
BTU/lb.	9820	
S.G.	1.550	

OVERALL RECOVERY 82.3%
766'9" to 781'



ROOF: dk grey sh.
6" (1" broken core at top) inferior coal & carb sh.
3½" (partly broken core) coal.
1" coaly sh ½" fawn sh
1½" inferior coal
12" (broken core) coal & 'bluey'.
2" coal.
1" 'bluey', ¾" coal
3½" coal & inferior coal.
4¼" coal with ¼" sh 1½" from top.
¼" shaly coal 2" inferior coal & coal
¼" fawn sh 1¼" inferior coal
¾" grey & fawn sh. ½" inferior coal fawn sh bands.
1½" (coaly broken core) inferior coal & coal.
5½" (partly broken core) inferior coal & coal.
6¼" coaly sh.
1'5½" (partly broken core) coal.
1½" fawn sh.
5½" (broken core) coal.
1" (broken core) coal
2¾" dk brown sh 1" dk brown sh.
½" inferior coal.
1'7¼" (broken core) coal, at least three fawn sh. bands.
1½" fawn sh.
1'11" (mainly broken core) coal, few sh. bands.
1½" sh & coal
4¾" (partly broken core) dk grey sh., few coal lents & ¼" 'boulder' near bottom

N.S.49

Proximate Analysis S, Cal. Value & S.G.		per cent Sampled
M%	1.4	
VM%	25.2	
FC%	44.0	
A%	29.4	83.8
S%	0.31	
Joules/Gm.	23830	
BTU/lb	10250	
SG	1.527	

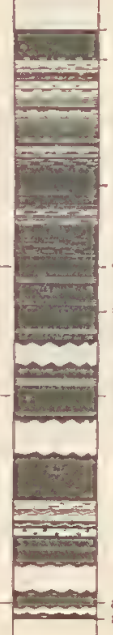
M%	1.2	
VM%	27.7	
FC%	46.1	
A%	25.0	66.1
S%	0.31	
Joules/Gm.	25850	
BTU/lb	11120	
S G	1.473	

Excluding 5½' shale 1" coal 2½" boulder at 814'

Composite sample of excluded bands at 814 ft

A%	66.8	
SG	2.318	

OVERALL RECOVERY
802'9½" to 816'10½" 83.4%



ROOF: fine white sandstone
1" coal
7" (broken core) coal
8" brown sh.
3½" brown sh
1" dk grey sh.
2½" (broken core) inferior coal, carb sh
2½" grey sh 2¼" dk grey sh 4 sh
2½" carb sh ½" coal, calcite lacing
3¼" dk grey sh.
3" carb sh with coal lents
7½" (broken core) carb sh with coal lents
carb sh 1" coal ¾" band
1½" carb sh with coal lents 2¼" brown sh
4" sh. & carb sh with three ½" bands coal
5" coal.
2½" (partly broken core) coal, inferior coal & 3" (broken core) coal & carb sh (carb sh & carb sh & coal lents
1" (broken core) coal, carb sh with coal lents
¾" dk grey sh 1" inferior coal & coal
1½" sh (worst) 1½" inferior coal & coal
¼" sh (worst)
2½" (broken core) coal, carb sh & sh
½" grey sh, ½" dull coal, ½" carb sh.
3" coal with sh lents
1'1" (broken core) coal with some carb. sh & sh.
1'6" (broken core) coal, carb sh. & some sh
2" coal
9½" (broken core) coal & a little carb. sh
1½" coal with one sh lent
¼" sh. 2" coal
4¾" (broken core) coal with few sh lents
5½" (partly broken core) grey sh
1" (broken core) coal
2½" boulder
3" coal with thin lents bands of carb sh
1" carb sh with bands of coal.
1" coal.
6" (broken core) coal, some carb sh & sh
1½" carb. sh with coal lents
1½" coal with one sh lent
FLOOR: dk grey sh

N.S.46

Proximate Analysis S, Cal. Value & S.G.		per cent Sampled
M%	1.2	
V.M.%	27.9	
F.C.%	43.7	
A%	27.2	100
S%	0.34	
Joules/Gm.	24910	
B.T.U./lb.	10720	
S.G.	1.492	

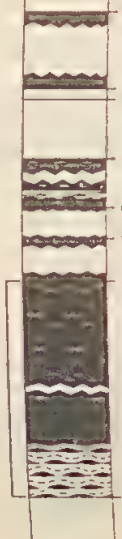
OVERALL RECOVERY 73.1%
567'2" to 579'6"

2" (broken core) coaly sh
570'5" 2" (broken core) coaly sh, 1" dk grey sh. Foreign sh. 3" buff sh.
7½" 'bluey'
½" fawn sh ½" dk grey sh 3½" 'bluey' & sh
572'2" ¾" 'bluey' & sh 1" inferior coal
572'4¾" ½" dk grey sh, coal lents ½" fawn sh
573' 7½" (partly broken core) coal
9¾" (partly broken core) coal.
1½" 'bluey'
9½" (partly broken core) coal, sh partings in bottom 4".
½" sh. ½" coal. ¾" fawn sh, coal lents
10" (partly broken core) coal.
576' 3½" coal.
8" coal.
½" fawn sh 1¾" coal
1'4" (broken core) coal, with at least one ½" & one ¾" sh band in top 5".
1" buff sh
8¾" (partly broken core) coal.
579' 1" sh & coal lents
579'6" 2½" (broken core) coal & sh.

N.S.43

Proximate Analysis S, Cal. Value & S.G		per cent Sampled
M%	1.2	
V M.%	25.8	
F.C.%	39.5	
A%	33.5	96.8
S%	0.27	
Joules/Gm.	22230	
B.T.U./lb.	9580	
S.G.	1.565	

OVERALL RECOVERY 58.0%
626'9" to 638'5"



7" (broken core) coal with little sh
No recovery.
No recovery · Drillers Report :- indication coal.
8½" (broken core) coal & some sh. with 2½" (solid core) sh with coal lents
1" inferior coal.
4" coal.
5'1" (fragmented core) coal, some inferior coal & sh, bottom 1'4" mainly sh.

N.S.48

Proximate Analysis S, Cal. Value & S.G.		per cent Sampled
M%	1.3	
V M.%	20.1	
F.C.%	33.7	
A%	44.9	99.1
S%	0.20	
Joules/Gm.	17890	
B.T.U./lb.	7700	
S.G.	1.701	

OVERALL RECOVERY 90.1%
668'1" to 674'10"

2" coal
1" sh
3" (broken core) coal & sh
2" coal. 1½" sh
2'5" (broken core) dull & bright coal with few bands & lents of sh ¾" buff sh about 1'9" from top, 1½" bright coal band 1'2" from top.
2" sh. with coal lents
3" (broken core) coal, carb sh & sh. 1" coal. 6½" sh & coal bands.
9" (broken core) carb. sh, sh & coal
2" carb sh
3" coal.
6" (broken core) carb sh & coal bands
5" carb sh & coal bands

To accompany report by A K Denmead M Sc

P.D.T.S. No. 17 MINE AREA **HAIGHMOOR** DIAGRAMS OF HAIGHMOOR BOTTOM SEAM DETAILS OF CORE RECOVERY AND ANALYSES

N.S.53

Proximate Analysis Recovery Section S, Cal Value & S.G.	per cent Sampled	Seam Section	Description
M% 1·3 VM% 23·8 F.C.% 42·2 A% 32·7 S% 0·29 Joules/Gm. 22810 B.T.U/lb 9810 S.G. 1555	100	392'4½" 395'5" 397' 400'6" 404' 407'	4" (partly broken core) coaly sh, some 3½" grey siltstone. 1" inferior coal. 1" brown sh. 5" carb sh., coal lenty in top 2". 1" buff sh. 4½" carb sh. 6" fawn sh. 5" carb sh. ½" inferior coal 3" buff sh 7' carb sh & coaly sh 1'7" (partly broken core) inferior coal, few carb. sh bands ¾" inferior coal. 4½" black carb. sh 2" (broken core) coal. 1½" inferior coal. 1'3½" (broken core) coal, some inferior coal. ½" carb sh. 5½" (partly broken core) inferior coal & coal; 1" carb sh 3" from bottom. ¾" sh., coal lenty 7" (broken core) coal. 2½" black carb sh ½" fawn & dk grey sh ½" carb sh 3½" (broken core) coal 5" (partly broken core) inferior coal & coal, ¼" boulder. ¼" carb sh 3½" carb sh & inferior coal. 1½" "boulder" 3½" carb sh & inferior coal. 12" light grey siltstone 3' grey sh. 1" brown sh. 4½" carb sh & inferior coal, few iron carb "nodules" at bottom 2½" carb sh & inferior coal, few iron carb "nodules" 2½" brown sh 2½" carb & coaly sh. [nodules. 2½" carb sh. 3" (partly broken core) inferior coal. ½" fawn sh. 5" inferior coal, some carb sh. ¾" fawn sh ¾" inferior coal. 3" carb & coaly sh., irregular "boulder" bands in last 4".

OVERALL RECOVERY 392'4½" to 407' 100%

N.S.57

Proximate Analysis Recovery Section S, Cal Value & S.G.	per cent Sampled	Seam Section	Description
M% 1·8 VM% 22·2 F.C% 34·1 A% 41·9 S% 0·29 Joules/Gm. 18500 BTU/lb 8130 SG. 1659	80	229'1" 231'1" 234' 234'3" 236'1" 240'3" 240'10½" 242'5" 244'6½"	8" (broken core) carb. sh & sh 5½" grey siltstone, fine sandstone in top 3" 2" carb. sh ¼" buff sh ¾" carb. sh 1¾" buff sh (1" buff sh 2¼" carb sh) 3" buff sh ½" buff sh 5" coaly sh 3" (broken core) coal, some sh 7" (broken core) coal, some sh. 1½" fawn sh 4½" (broken core) coal, some sh. 1½" fawn sh 1¾" inferior coal. ½" fawn sh 1" carb. sh 5" (broken core) coal with sh. 1¾" (broken core) grey sh. 2'8" (broken core) coal, some sh ¾" grey sh. 1" "bluey" ½" (broken core) coal 5½" (broken core) coal, some sh. 2½" grey sh. 6" (broken core) coal, few sh lenty 3" grey sh. 7" (partly broken core) coal, ¼" sh. 1" from bottom. 1½" grey sh. 12½" (broken core) coal, sh lenty
M% 1·4 VM% 25·1 FC% 39·8 A% 33·7 S% 0·40 Joules/Gm 22520 BTU/lb 9690 S G 1·552	77·4		Excluding 2½" grey shale at 240'10½" ⅜" grey sh at 241'6" 1½" grey sh at 242'5
Composite of excluded bands A% 79·1 SG 2·494			OVERALL RECOVERY 229'1" to 244'6½" 67·7%

N.S.56

Proximate Analysis Recovery Section S, Cal Value & SG	per cent Sampled	Seam Section	Description
M% 1·3 VM% 23·8 FC% 37·5 A% 37·6 S% 0·31 Joules/Gm. 20610 BTU/lb 8870 SG 1620	100	228'11½" 231'9" 232'9" 235'9" 236'7¼" 237'9½" 238'0¼"	ROOF shale 4½" dk. gy sh 4" carb sh 2" siltstn (irreg) 1" carb sh ½" fawn sh 3½" carb sh & inf coal 4½" coaly sh. ½" fawn sh 1'0" inf. coal & coal 17" inf coal & coal ¼" fawn sh. 1" inf. coal ½" fawn sh 2½" inf coal 1½" fawn sh 2½" inf. coal ¾" boulder (irreg) 8" inf coal & coal 10½" inf coal & coal. 2½" fawn sh 6" carb sh 1" fawn sh 4½" inf coal & carb. sh ¾" sh arenite. 2" gy sh FLOOR shale
A% 60·1 SG. 1·909	100		

OVERALL RECOVERY 228'11½" to 238'0¼" 88·0%

NE 22·11·54

P.D.T.S. No. 17 MINE AREA **HAIGHMOOR** DIAGRAMS OF ? TANTIVY SEAM · DETAILS OF CORE RECOVERY AND ANALYSES

N.S.47

Proximate Analysis Recovery Section S, Cal Value & S.G.	per cent Sampled	Seam Section	Description
M% 1·2 V.M.% 28·6 F.C.% 46·2 A% 26·0 S% 0·38 Joules/Gm. 25760 B.T.U/lb. 11090 S G 1·470	82·1	655'10" 657' 657'6" 659'10¾"	7⅞" (broken core) coal. 8" fawn sh. 4½" (partly broken core) coal. 1½" coal 1½" dk grey sh, irregular fawn band at bottom. 8" (partly broken core) coal. 2" fawn & dk grey sh. 1'1" inferior coal with shaly bands

OVERALL RECOVERY 655'10" to 659'10¾" 82·1%

N.S.46

Proximate Analysis Recovery Section S, Cal Value & S.G.	per cent Sampled	Seam Section	Description
M% 1·4 V.M.% 27·5 F.C.% 46·3 A% 24·8 S% 0·36 Joules/Gm. 25960 B.T.U./lb. 11170 S G 1·463	100	449'2½" 451'7" 453'8"	5" (broken core) coal 2" (partly broken core) sh & coal bands 2½" buff sh 4½" sh with coal bands. 7¼" (broken core) coal, sh. lens 2½" 2'8" dk grey sh with irregular 2" buff band near bottom. 3½" (broken core) coal. 3½" coal 3" (broken core) coal. 2" buff sh with carb lenty 1" inferior coal 2" coal. 8" (broken core) coal, few sh frag'ts 3" coal 1" (broken core) coal 1" coal 4" coal

OVERALL RECOVERY 449'2½" to 453'8" 100%

N.S.55

Proximate Analysis Recovery Section S, Cal Value & S.G.	per cent Sampled	Seam Section	Description
M% 1·6 V.M.% 23·6 F.C.% 40·7 A% 34·1 S% 0·30 Joules/Gm 22370 B.T.U /lb. 9620 S.G. 1556	100	220'2" 222' 224' 225'4"	1'0½" (partly broken core) inferior coal, some sh ½" fawn sh 3" (broken core) inferior coal 6" (broken core) coal & inferior coal 1'10" (broken core) coal & inferior coal, 4" with fawn sh 7" from top, some fawn sh in last 3" 2" (broken core) inferior coal & carb sh., some sh 1'4" (partly broken core) inferior coal & carb sh, some sh

OVERALL RECOVERY 220'2" to 225'4" 100%

To accompany report by A.R. Fennaird M.Sc.

P.D.T.S No.17 MINE AREA

HAIGHMOOR

SECTIONS OF HAIGHMOOR TOP SEAM IN MINE WORKINGS

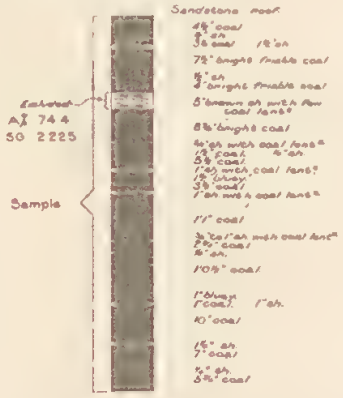
Note: For position of samples in Mine see plan

Scale of Feet

S1

HAIGHMOOR EXTD. NO.1 COLLIERY

NORTH EAST WORKINGS



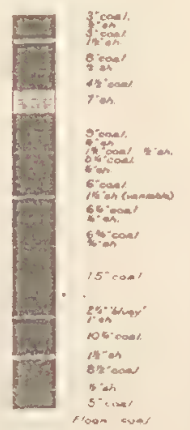
Total Thickness Sampled
8'11½"

Sample excluding 5" brown sh.		Sample including 5" brown sh.	
M%	1.4	M%	1.4
VM%	27.7	VM%	26.9
FC%	43.9	FC%	41.9
A%	27.0	A%	29.8
S%	0.42	S%	0.38
Joules/Gm	24980	Joules/Gm	23820
BTU/lb	10750	BTU/lb	10240
SG	1.484	SG.	1.517

S2

HAIGHMOOR EXTD. NO.1 COLLIERY

NORTH EAST WORKINGS

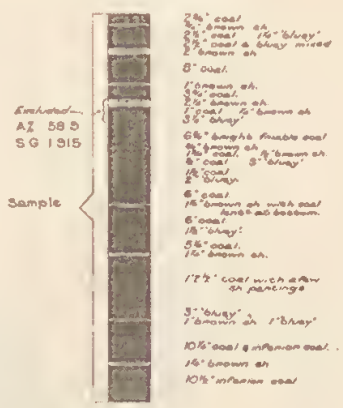


Section only

S3

HAIGHMOOR EXTD. NO.1 COLLIERY

SOUTH EAST WORKINGS



Total Thickness Sampled
9'2½"

Sample excluding 'badger'		Sample including 'badger'	
M%	1.4	M%	1.4
VM%	28.5	VM%	27.6
FC%	42.9	FC%	41.8
A%	27.2	A%	29.2
S%	0.39	S%	0.37
Joules/Gm.	24830	Joules/Gm	23990
BTU/lb.	10680	BTU/lb	10320
SG	1.494	SG	1.519

S4

HAIGHMOOR EXTD. NO.1 COLLIERY

SOUTH WEST WORKINGS

Total Thickness Sampled
7'7½"

Sample excluding badger		Sample including badger	
M%	1.6	M%	1.5
VM%	25.6	VM%	25.2
FC%	42.0	FC%	40.3
A%	30.8	A%	33.0
S%	0.36	S%	0.34
Joules/Gm	23520	Joules/Gm	22760
BTU/lb.	10120	BTU/lb	9800
SG.	1.517	SG	1.544

NE 13.8.54

To accompany report by A.K. Denmead M.Sc.

P.D.T.S. No17 MINE AREA

HAIGHMOOR

SECTIONS OF HAIGHMOOR BOTTOM SEAM IN MINE WORKINGS

Note: For position of samples in Mine see plan.

Scale of Feet

S1

HAIGHMOOR EXTD NO.1 COLLIERY

NORTH WEST WORKINGS

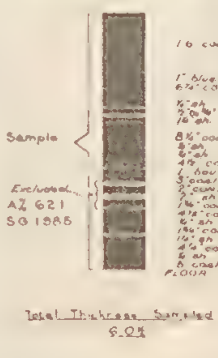
Total Thickness Sampled
6'5"

Sample excluding badger		Sample including badger	
M%	1.3	M%	1.4
VM%	27.3	VM%	25.1
FC%	46.0	FC%	40.6
A%	25.4	A%	32.9
S%	0.38	S%	0.36
Joules/Gm	25650	Joules/Gm	22630
BTU/lb	11030	BTU/lb	9740
SG	1.470	SG	1.550

S2

HAIGHMOOR EXTD NO.1 COLLIERY

SOUTH WEST WORKINGS



Total Thickness Sampled
6.0½

Sample excluding badger		Sample including badger	
M%	1.4	M%	1.5
VM%	27.1	VM%	26.3
FC%	45.1	FC%	42.6
A%	26.4	A%	29.6
S%	0.33	S%	0.32
Joules/Gm	25300	Joules/Gm	23930
BTU/lb	10890	BTU/lb	10300
SG	1.481	SG	1.515

S3

HAIGHMOOR EXTD NO.1 COLLIERY

SOUTH EAST WORKINGS

Total Thickness Sampled
6'11½"

Sample excluding badger		Sample including badger	
M%	1.3	M%	1.3
VM%	28.4	VM%	27.1
FC%	47.1	FC%	40.9
A%	22.6	A%	30.7
S%	0.40	S%	0.33
Joules/Gm	26760	Joules/Gm	23300
BTU/lb	11520	BTU/lb	10030
SG	1.445	SG	1.540

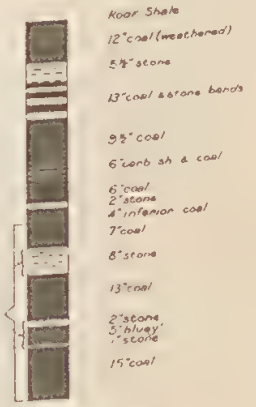
Composite sample of excluded badgers:

A% 62.4

SG 2.034

S4

OLD TUNNEL FOR 62



Total Thickness Sampled
4'3"

Sample excluding badger	
M%	3.9
VM%	21.9
FC%	55.9
A%	18.3
BTU/lb	10570

NE 13.12.54

To accompany report by A.K. Denmead M.Sc.

P.D.T.S. No. 17 MINE AREA HAIGHMOOR DIAGRAMS OF UNNAMED SEAM DETAILS OF CORE RECOVERY AND ANALYSES

N.S.47

Proximate Analysis S, Cal. Value & S.G.	Recovery per cent Sampled	Seam Section	Description
M% 1·5 V.M% 25·7 F.C.% 41·3 A% 32·0 S% 0·31 Joules/Gm. 22710 B.T.U./lb. 9770 S.G. 1·548	97·4	339'07¾" 339 2' 342'2" 343'9¾"	1¼"(broken core) coal, some sh. & 'bluey' 2'6¾"(mainly broken core) coal, some sh. & 'bluey' 1½" dk. grey sh. 3¾" coal. 7½"(broken core) coal, some carb. sh. 2½"(broken core) fawn sh. ¼" coal. 1½" dk. grey sh., coal lenti. 6"(broken core) coal, some sh.

OVERALL RECOVERY 97·4%
339'0¾" to 343'9¾"

N.S.48

Proximate Analysis S, Cal. Value & S.G.	Recovery per cent Sampled	Seam Section	Description
M% 1·4 V.M.% 27·2 F.C.% 45·7 A% 25·7 S% 0·30 Joules/Gm. 25570 B.T.U./lb. 11000 S.G. 1·474	65·2	343' 344' 346' 348' 348'9"	6½"(2" broken core at top) coal 1¼" cream sh. 2½" inferior coal. 1¼" cream sh. 10"(broken core) coal 1½" hard carb. sh. 1" cream sh. 2"(broken core) coal. 1" coal. 1'1"(broken core) coal with ½" buff sh. 5" from top and 1" fawn sh. 10" from top. 4"(broken core) coal. 1"(broken core) inferior coal

OVERALL RECOVERY 65·2%
343' to 348'9"

To accompany report by A. K. Denmead, M.Sc.

SKELETON PLAN
P.D.T.S. No. 17 MINE AREA
HAIGHMOOR
IPSWICH COALFIELD
Structure Contours
Haighmoor Top Seam

To accompany report by A.K.Denmead, M.Sc.
Structure contours by J.O.Cuthbert, B.Sc.

Scale of Chains

Twenty chain grid on True North. Elevations in feet on State Datum
Structure contours on base of seam

Legend

Colliery (Working)	HAIGHMOOR	Diamond Drillhole	ONS64
Colliery (Abnd)	GLENCOMA	Percussion Drillhole	o Bore 6 (P)
Adit	ADIT	Structure Contours	—500—
Shaft		Fault	-------
Inferred, probable or indefinite fault			--?--?--
Structure contours above ground level shown			500 ·

N.English, Del

HAIGHMOOR EXTD No1
OLD ADIT
BELL ADIT(A)
Air Shaft
OLD ADITS (Collapsed)
OLD TRIAL ADIT (Collapsed)
Bore 5(P)
Bore 11(P)
Bore 4(P)
Bore 22(P)
Bore 21(P)
Bore 1(P)
Bore 18(P)
Bore 20(P)
Bore 19(P)
Bore 16(P)
Bore 7(P)
Bore 15(P)
Bore 17(P)
Bore 6(P)
Bore 8(P)
ONS54
ONS57
ONS55
ONS8
ONS53
ONS67
ONS56
ONS51
ONS50
ONS52
ONS46
ONS43
ONS45
ONS48
ONS47
ONS49
BREMER
R
Sandy
Ck.
49000N
38000N
34000N
-100
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
-550
-600
-650
-700

SKELETON PLAN
PDTS No 17 MINE AREA
HAIGHMOOR
IPSWICH COALFIELD
STRUCTURE CONTOURS
HAIGHMOOR BOTTOM SEAM

To accompany report by A K Denmead. M Sc
Structure contours by J O Cuthbert. B Sc

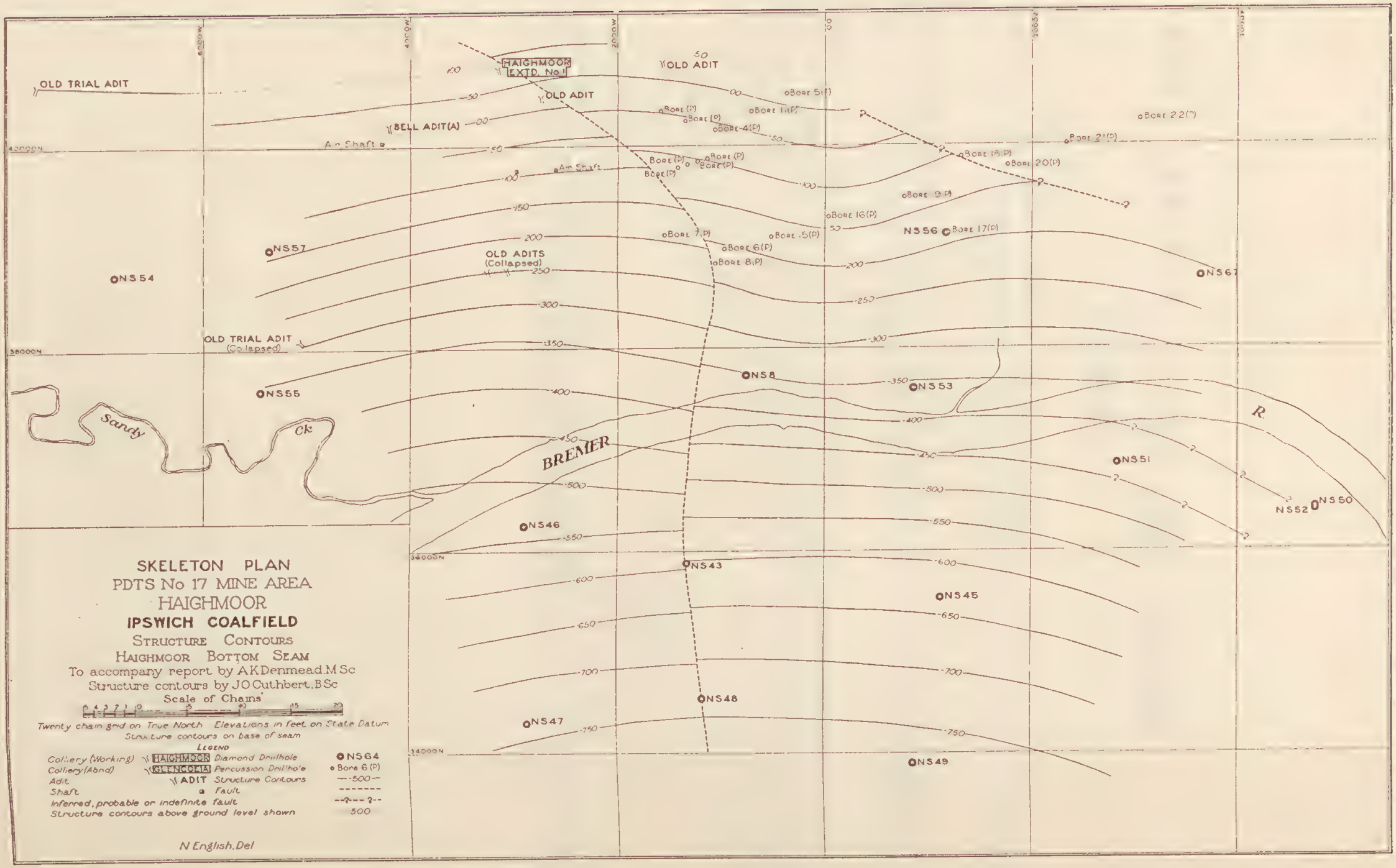
Scale of Chains
6 4 3 2 1 0 5 10 15 20

Twenty chain grid on True North Elevations in feet on State Datum
Structure contours on base of seam

LEGEND

Colliery (Working)	HAIGHMOOR	Diamond Drillhole	ONS64
Colliery (Abnd)	GLENCOLA	Percussion Drillhole	o Bore 6 (P)
Adit	ADIT	Structure Contours	—500—
Shaft		Fault	--------
Inferred, probable or indefinite fault			--?--?--
Structure contours above ground level shown			500

N English. Del



PART 4. P.D.T.S. No. 16 MINE AREA, ABERMAIN.

SUMMARY.

Testing of P.D.T.S. Mine Area No. 16 based on Rylance Abermain Colliery, North Ipswich, was carried out between December, 1952, and August, 1953, by nine bores (N.S. 58 to 66) ranging from 74 ft. to 1,337 ft. and aggregating 7,808 ft.

Outcropping on the northern side of the area, the coal measures pass to the south under Tertiary cover up to 360 ft. in thickness, the junction between the formations being masked by alluvial cover up to 100 ft. thick along the Bremer River.

All eight of the worked seams of the North Ipswich area, here contained in some 850 ft. of measures, were recognisable at progressive stages of the drilling campaign but, for reasons outlined, estimates of reserves could be made only in the case of the Waterstown, Tivoli and Eclipse seams and then only on the basis of "inferred" reserves. The 800,000 tons aggregate of such reserves was made up as follows:—

Waterstown Seam	300,000 tons
Tivoli Seam	250,000 tons
Eclipse Seam	250,000 tons

With no measured reserves (due possibly in part to incomplete core recoveries in some of the bores) scope for large scale exploitation in the area drilled appears to be small.

Introduction.

Upon completion of drilling in No. 17 (Haighmoor) Mine Area, drilling of the adjacent No. 16 area was undertaken. This area is based on Rylance Abermain Colliery in which the Eclipse seam is being exploited. The P.D.T.S. programme involved the sinking of nine boreholes at 20 chain intersections. Boring commenced in December, 1952, and finished in August, 1953. Nine holes numbered N.S. 58 to N.S. 66, which included one shallow re-drill, were bored. Depths ranged from 74 ft. to 1,337 ft. and aggregated 7,808 ft. Three plants were employed. Those concerned in the compilation of data in connection with the preparation of this report include J. O. Cuthbert (field mapping), A. M. McKenzie (core logging), B. W. Hawkins (surface and underground mapping and sampling) and J. B. Cameron (core logging and underground sampling and mapping).

Accompanying this report are the following plans and sections:—

Fig. 1. A map showing P.D.T.S. Mine Area No. 16, survey grid, surface contours, bore locations, underground workings (with sample locations), and a locality map.

Fig. 2. A map showing P.D.T.S. Mine Area No. 16, survey grid, bore locations, surface contours and surface geology.

Fig. 3. Cross sections.

Fig. 4. Generalised bore sections.

Fig. 5. Diagrams showing detailed sections of Eclipse Seam in boreholes with core recoveries and analytical data.

Fig. 6. Diagrams showing detailed sections of Miscellaneous Seams in boreholes with core recoveries and analytical data.

Fig. 7. Diagrams showing detailed seam sections in Rylance Abermain Colliery with analytical data.

Geological Features.

The general geological picture here is similar to that in No. 17 (Haighmoor) Mine Area. The coal measures crop out on the northern side of the Bremer River, while to the south of that stream there are Tertiary sediments. The boundary between the two formations is obscured by river alluvium which flanks the river on both banks, but is more widespread in the south, having been pierced in every borehole on that side of the river. There is a gravel bed at the base of the alluvium which appears to be carrying a large volume of water. The greatest thickness of alluvium penetrated was 100 ft. (in borehole No. N.S. 65), the base of the alluvium at this point being 57 ft. below sea level.

The Tertiary strata are largely light grey mudstone with some development of siltstone and argillaceous sandstone towards the base. There are occasional carbonaceous bands, the bulk of the carbonaceous matter being carbonised wood with a few dicotyledonous leaf fragments. The greatest thickness of Tertiary strata penetrated was approximately 360 ft. (in borehole No. N.S. 65).

Ipswich Coal Measures.—All eight of the worked seams of the North Ipswich mining district were penetrated during the course of the drilling campaign. These seams, which are contained in some 850 ft. of strata in this area, are (in descending order):—

Garden	Unnamed
Tantivy	Tivoli
Fiery	Eclipse
Waterstown	Benley

Garden Seam.—What is probably the horizon of the Garden Seam was penetrated in three bores. In each case it was represented by thin coal plies and a good deal of carbonaceous shale with nothing approaching a workable section.

Tantivy Seam.—Like the Garden Seam the Tantivy Seam did not show a possibly workable section, though the coal plies were rather thicker and more numerous. These two seams are about 100 ft. apart.

Fiery Seam.—As exposed in the Rylance Abermain cross-measure adit the Fiery Seam is a succession of thin coal, shale and "bluey" bands about 22 ft. thick. Twelve feet from the roof there is a section 4 ft. 6 in. thick that contains 3 ft. 4 in. of coal in four bands, but there is no other possibly workable section. In borehole No. N.S. 60 there were five coal plies aggregating 3 ft. 5 in. in a section 4 ft. 4 in. thick 9 ft. from the roof. With the two exceptions mentioned the Fiery Seam did not show a possibly workable section. In two of the bores (N.S. 58 and N.S. 63) the seam was wanting altogether, being represented by black, sometimes carbonaceous shale with coal laminae. The Fiery Seam hereabouts lies from 100 to 150 ft. stratigraphically below the Tantivy Seam.

Waterstown Seam.—As worked in the old Waterstown pit in portions 39, 40 and 41 the Waterstown seam had a thickness of 2 ft. 4 in. with a stone band 1 to 1½ in. thick a foot or so from the floor. Overlying this section there are 9 in. of coal with shale partings succeeded by 5 in. of shale and then sandstone. In the floor there is a succession of coal and shale bands. Some of the old pillars have recently been driven through and the material immediately above and below the previously worked section was mined to give an overall working height of 4 ft. or more. Very little was seen of the Waterstown seam during the course of the drilling campaign due in part to core losses and in some cases to the non-existence of the seam. In the one hole (N.S. 63)

where a complete section of the seam was seen the possibly workable thickness was 2 ft. 5¼ in. In other holes where core loss occurred maximum possible thicknesses are N.S. 58 3 ft. 9 in. (virtually no coal recovered); N.S. 59 2 ft. 6 in. (correlation uncertain); N.S. 60 3 ft. 5 in.; N.S. 61 4 ft. The seam was wanting in N.S. 64. The Waterstown seam is usually 50 ft. or less stratigraphically below the Fiery Seam.

Tivoli Seam.—In the Rylance Abermain cross measure adit the Tivoli Seam is separated from the overlying Waterstown seam by 250 ft. of strata, chiefly sandstone. There are a couple of carbonaceous sections between 170 ft. and 190 ft. below the Waterstown Seam, neither of which showed any promise of developing into a workable seam. The Tivoli Seam here is not workable, there being but 2 ft. 2 in. of coal in a section 5 ft. 4 in. thick. In only one of the bores (N.S. 60) did the Tivoli Seam show anything like a workable section. In this hole the seam was 6 ft. 7 in. thick with a stony section 10 in. thick in the middle. Excluding 5 in. of shale the section gave an ash value of 29·1 per cent. There is a general improvement in the Tivoli Seam approaching the Tivoli Fault from the north-east and it is expected that there will be a narrow strip (perhaps 10 chains wide) of workable coal in this seam along the south-western edge of the bored area.

Eclipse Seam.—This seam is divisible into three sections. The top section, usually described as the "dirty tops" varies considerably in thickness, attaining its acme (6 ft. 9 in.) in Rylance Abermain Colliery. In the cross-measure adit the top 4 ft. 7 in. of the "tops" include but three stone bands aggregating 8½ in. in thickness, below which there are 2 ft. 2 in. of stone and coal bands. Then follows the main or middle section which alone was worked by the old Abermain Co. The "middles" have a thickness of approximately 5 ft. Except for a "badger" 5 to 6 in. thick 1 ft. 9 in. from the floor this section is usually unbanded. The "dirty bottoms" are 2 ft. to 2 ft. 6 in. thick and comprise a "badger" about 8 in. thick at the top and under that 18 in. of coal with two or three thin shale bands. The sections at present being worked in Rylance Abermain Colliery are the middles and the "dirty bottoms."

The Eclipse seam was recognised in only three of the eight bores put down in this area. One hole (N.S. 58) which was drilled very close to mine workings was stopped before it reached the seam, in the remaining four holes the seam was either wanting or, because of uncertainties of correlation was not recognised.

In two of the three holes in which the Eclipse seam *was* recognised core recoveries were unsatisfactory and what core was recovered was so badly broken that it was impossible to reconstruct the seam section with any certainty. In all cases ash content of core samples exceeded 35 per cent.

Benley Seam.—A coaly section between 1,272 ft. 6 in. and 1,292 ft. in borehole No. N.S. 64 is tentatively correlated with the Benley Seam. A section 4 ft. 6 in. thick 3 ft. 8 in. from the floor from which 5 in. of shale in four bands had been excluded showed 23·1 per cent. ash. A thick coaly section in borehole No. N.S. 65 which does not show any workable section may possibly be the Benley Seam.

The area is traversed by a number of dip faults. The Boxwood Fault—a major structural dislocation—separates the Abermain Mine Area from the Haighmoor Area. On the south-west side of the Boxwood Fault the strata are faulted and folded over a wide zone and as a result the seams in this zone occur in a number of more or less dismembered blocks mostly of small area. A dip fault which passes near Rylance Abermain tunnel mouth has seriously restricted the development of the Eclipse seam in the colliery, no coal having yet been worked between it and the Boxwood Fault. The Bishop Fault which lies between the fault just described and the Boxwood Fault has not been identified for certain in this property but it is believed that it will be found to be present, at least north of the Bremer River.

The Abermain Mine Area is bounded on the south-west by the Tivoli Fault. This is a normal fault which, where penetrated in the old Abermain workings, had a south-westerly hade and a downthrow of approximately 90 ft. to the south-west. The old mine plans show a second fault between the Tivoli and Bishop Faults which like most dislocations in this area, appears to die out rapidly going north-west.

The multiplicity of faults has adversely affected mining operations and incidentally they have to no small degree intensified the difficulty of correlation between the various bores.

It is evident from the drilling that, with the possible exception of the Benley Seam, all the seams from the Fiery down deteriorate going south-east. This factor, coupled with the heavy faulting, have made correlations between boreholes most difficult. Boreholes for which no correlations could be made are N.S. 65 and N.S. 66. Doubtful correlations were made in the case of boreholes N.S. 58, N.S. 59, N.S. 64.

In borehole No. N.S. 58 nothing that could legitimately be described as a seam was seen. In the expected position of the Waterstown Seam, i.e., between 331 ft. and 337 ft., core loss amounted to 3ft. 9 in. while core recovered included 6 in. of coal in five bands, as well as a good deal of carbonaceous shale. The location of the coal 1 ft. 5 in. below a thin (7 ft.) sandstone bed suggests that the horizon was that of the Waterstown Seam. The maximum possible workable thickness of the seam here would be almost 4 ft. The Tivoli seam was not seen in this hole; there was not even a carbonaceous section to mark its horizon.

Borehole N.S. 59 was drilled in the (usually) disturbed area between the Bishop and Boxwood Faults. No possibly workable coal was penetrated. A section of shale and coal bands between 431 ft. 8 in. and 451 ft. 8 in. is tentatively correlated with the Fiery Seam, while a coaly section between 470 ft. 6 in. and 478 ft. 6 in. from which 2 ft. 6 in. of core were

lost is regarded as representing the Waterstown Seam. The core here showed fracturing and it is possible that the non-appearance of the seam may have been due to faulting. At the expected horizon of the Tivoli Seam there was a coaly section some 9 ft. thick which included some 3 ft. 6 in. of inferior coal in four bands. No seam that could be correlated with the Eclipse was penetrated; its absence may be attributable to faulting of which there was some evidence hereabouts.

Borehole N.S. 65 revealed no workable coal and none of the seam horizons could be positively identified. A section 26 ft. thick near the bottom of the hole is very tentatively correlated with the Benley Seam.

No seam was recognised beyond doubt in borehole N.S. 64. The three uppermost coal horizons were tentatively correlated respectively with the Garden Seam, the Tantivy Seam and the Fiery Seam. There was a carbonaceous section 50 ft. below the (?) Fiery Seam which could be the horizon of the Waterstown Seam. A coaly section 9 ft. thick at 971 ft. has been very tentatively correlated with the Tivoli Seam and a rather thinner section at 1,026 ft. may possibly be the Eclipse Seam. There was a coaly section from 1,272 ft. to 1,292 ft. which may be the Benley Seam. This included a 4 ft. 6 in. section that yielded 23·1 per cent. ash after the stone bands had been taken out.

Borehole N.S. 66 was drilled directly down dip from borehole No. N.S. 59. No correlation could be established with the latter nor with any other borehole. Between 726 ft. 6 in. and 737 ft. 9 in. in a succession of coal and shale bands there was a section 2 ft. 7½ in. thick which contained 2 ft. 1½ in. of coal and yielded 27·7 per cent. ash. Between 1,284 ft. and the bottom of the hole (1,337 ft.) there were a couple of rather ill-defined carbonaceous sections that may perhaps represent split sections of the Benley Seam.

Description of the Coal.—The coal throughout the Abermain Area, where reasonably free from mineral matter, is bright and friable with the well developed columnar cleavage that is characteristic of the North Ipswich coals. Fixed carbon (dry, mineral matter-free coal basis) of samples analysed ranged from 62·67 per cent. to 71·40 per cent. The latter was exceptional, the next highest being 66·68 per cent. With the one exception already mentioned the coal falls in the high volatile bituminous group. Moisture, even in the high ash coals, is low, the maximum figure being 1·7 per cent. Sulphur is about 0·3 per cent. for the Fiery Seam, 0·4 per cent. for the Waterstown and 0·2 per cent. for the Eclipse.

Coal Resources.

Under the previously adopted scheme of excluding from the estimated reserves all samples having an ash content in excess of 35 per cent. or having a thickness of less than 2 ft. 6 in. it is not possible to certify to any reserves in the Abermain Mine Area.

Eclipse Seam.—Measured reserves are nil. It is not at all unlikely that with fuller core recoveries two of the three bore sections sampled would have given ash values less than 35 per cent., though this could not be counted on. Even if such were the case reserves would not exceed 250,000 tons. Owing to poor core recoveries it was felt that no useful purpose would be served by conducting washability tests on the samples.

Tivoli Seam.—Measured and indicated reserves are nil. As previously stated there is believed to be a narrow strip of workable coal in the Tivoli Seam adjacent to the Tivoli Fault about 10 chains in width in which reserves are estimated to be of the order of 250,000 tons.

Waterstown Seam.—Measured reserves are nil. Because of poor core recoveries in all but one borehole and because of lack of information as to the extent of the old workings and the condition of the seam therein the prospects of this seam are not easy to assess. The maximum proved thickness of coal in boreholes was only 2 ft. 5¼ in. If it be assumed that all core lost from the relevant sections was coal, then the thickness of the seam would range from 2 ft. 5½ in. to 4 ft. and would average 3 ft. 4 in. The indications are that the seam will not be workable far beyond (south of) the Bremer River. Assuming first that the seam is workable in boreholes Nos. N.S. 58, 60 and 61, second that it would be worked as far as N.S. 63 (thickness 2 ft. 5¼ in.), third that the old workings are as shown on the plan, and fourth that the seam was workable all along the lowest level, then the reserves would be approximately 300,000 tons.

Fiery Seam.—This seam is subject to very rapid variation not only in total thickness, but also in the thickness of the constituent coal and stone plies. For this reason and notwithstanding the existence of a near-workable section in the cross-measure adit and a workable section in borehole N.S. 60, the seam is not considered capable of economic exploitation in this area.

Tantivy and Garden Seams.—No possibly workable section was found in either of these seams.

To sum up, it appears that the Abermain Mine Area offers little scope for large scale exploitation. Measured reserves are nil, due possibly in part to incomplete core recoveries in some of the bores. In the case of the Waterstown and Eclipse Seams it has not been easy to decide in what category to place reserves because the estimates are based largely on the assumption that what core was lost at known or expected positions of coal seams consisted wholly of coal. In view of the grave uncertainty as to the correctness of this assumption it has been decided to call them all "inferred" reserves.

Total "inferred" reserves, then, amount very approximately to 800,000 tons, made up as follows:—

Waterstown Seam	300,000 tons.
Tivoli Seam	250,000 tons.
Eclipse Seam	250,000 tons.
Total	800,000 tons.

4th March, 1955.

A. H. TUCKER, Government Printer, Brisbane.

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

P.D.T.S. No. 16 MINE AREA

ABERMAIN

IPSWICH COALFIELD

County of Stanley · Parishes of Ipswich & Chuwar

Showing mine workings, topography & boreholes

To accompany report by A.K. Denmead M.Sc.

Topographical Survey by E. Cowley

Scale of Chains

5 0 5 10 15 20

Twenty chain grid on True North. Elevations in feet on State Datum.

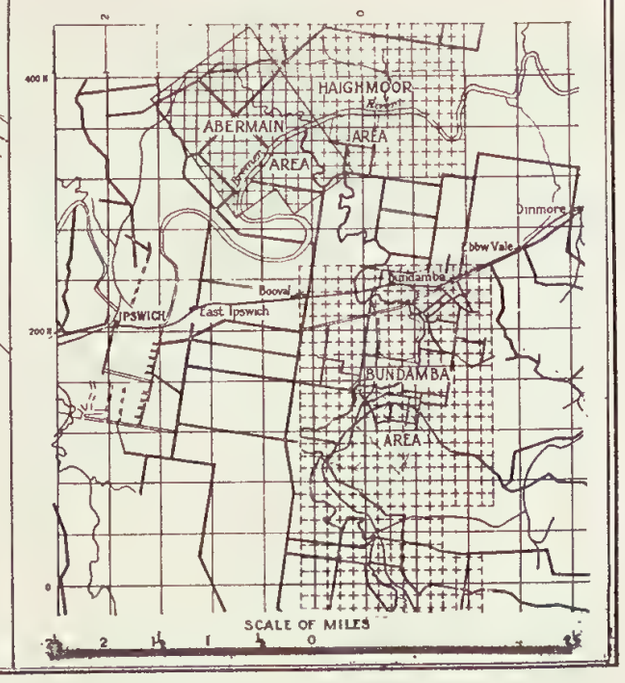
LEGEND

- Workings on Fiery Seam
- Workings on Tivoli Seam
- Fault in Mine Workings
- Stone Drive
- Diamond Drillhole
- Percussion Drillhole
- Surface Contours
- Section Line
- Workings on Waterstown Seam
- Workings on Eclipse Seam
- Section taken in Mine Workings
- Colliery (Working)
- N.S.61 Colliery (Abandoned)
- Bore (P)
- 60 Adit
- A—A' Shaft
- ES1
- NEATH
- NEATHA
- ADIT

N. English, Del.

FIG. 1

LOCALITY MAP



DEPARTMENT OF MINES, QUEENSLAND

GEOLOGICAL MAP

P.D.T.S. No. 16 MINE AREA

ABERMAIN

IPSWICH COALFIELD

County of Stanley · Parishes of Ipswich & Chuwar

Showing geology, topography & boreholes

To accompany report by A.K. Denmead, M.Sc.

Geology by J.O. Cuthbert, B.Sc. & B.W. Hawkins, B.Sc.

Topographical Survey by E. Cowley

Scale of Chains

5 0 5 10 15 20

Twenty chain grid on True North. Elevations in feet on State Datum.

LEGEND

- Established geological boundary, - position accurate
- position approx.
- Inferred, probable or indefinite boundary
- Established fault - position accurate
- position approx
- concealed
- Inferred, probable or indefinite fault
- Inferred, probable or indefinite fault, concealed
- High angle fault
- Ipswich Coal Measures
- Alluvium
- Coal Seam at Surface
- Outcrop
- Strike & dip of strata
- Strike & dip of joints
- Colliery (Working)
- Colliery (Abandoned)
- Adit
- Shaft
- Diamond Drillhole
- Percussion Drillhole
- Surface Contours

HAIGHMOOR

NOBLEVALE ADIT

NS.61

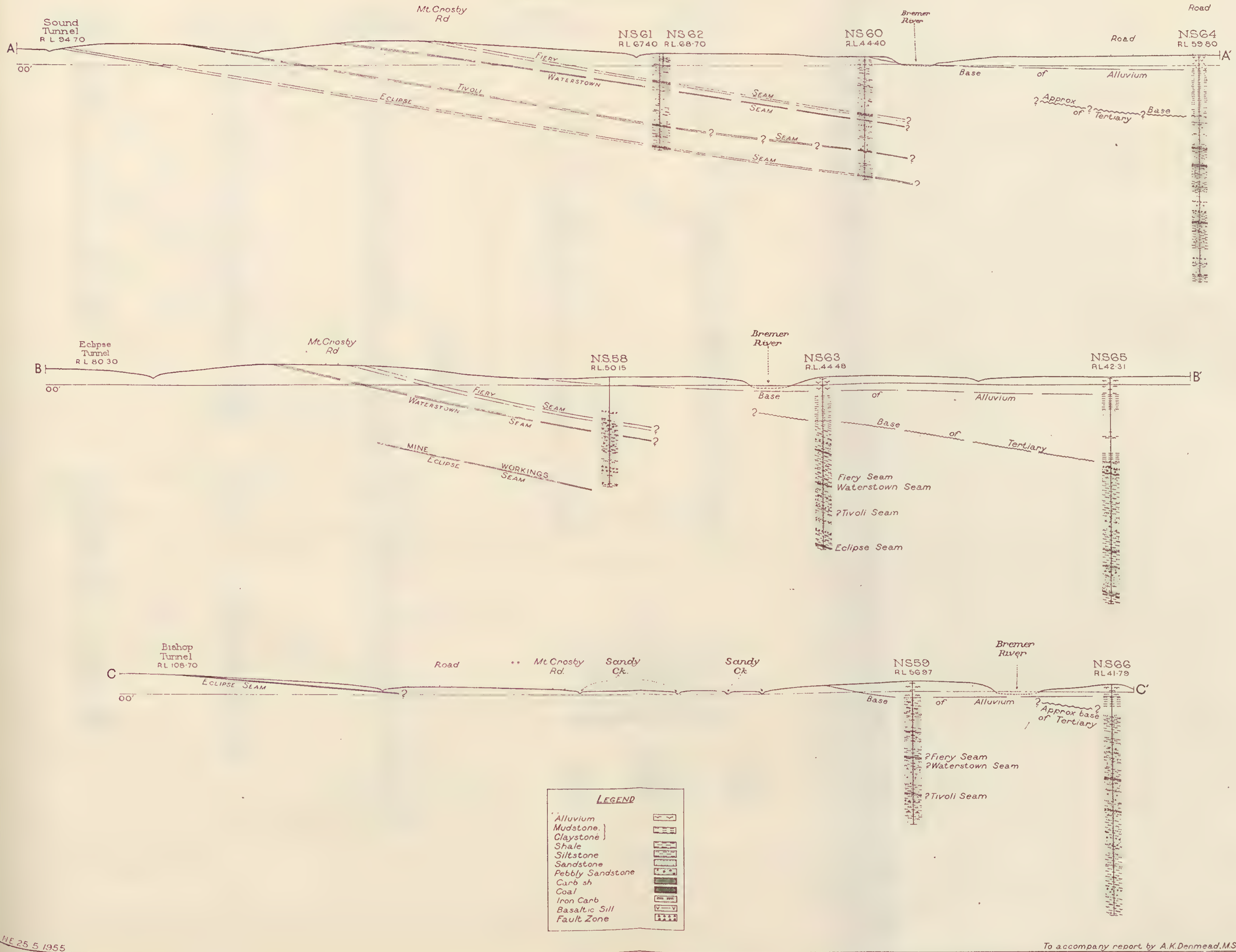
Bore 11(p)

FIG.2 N. English, Del.

P.D.T.S. No.16 MINE AREA
ABERMAIN
CROSS SECTIONS

Scale of Chains
5 0 5 10 20

FIG.3

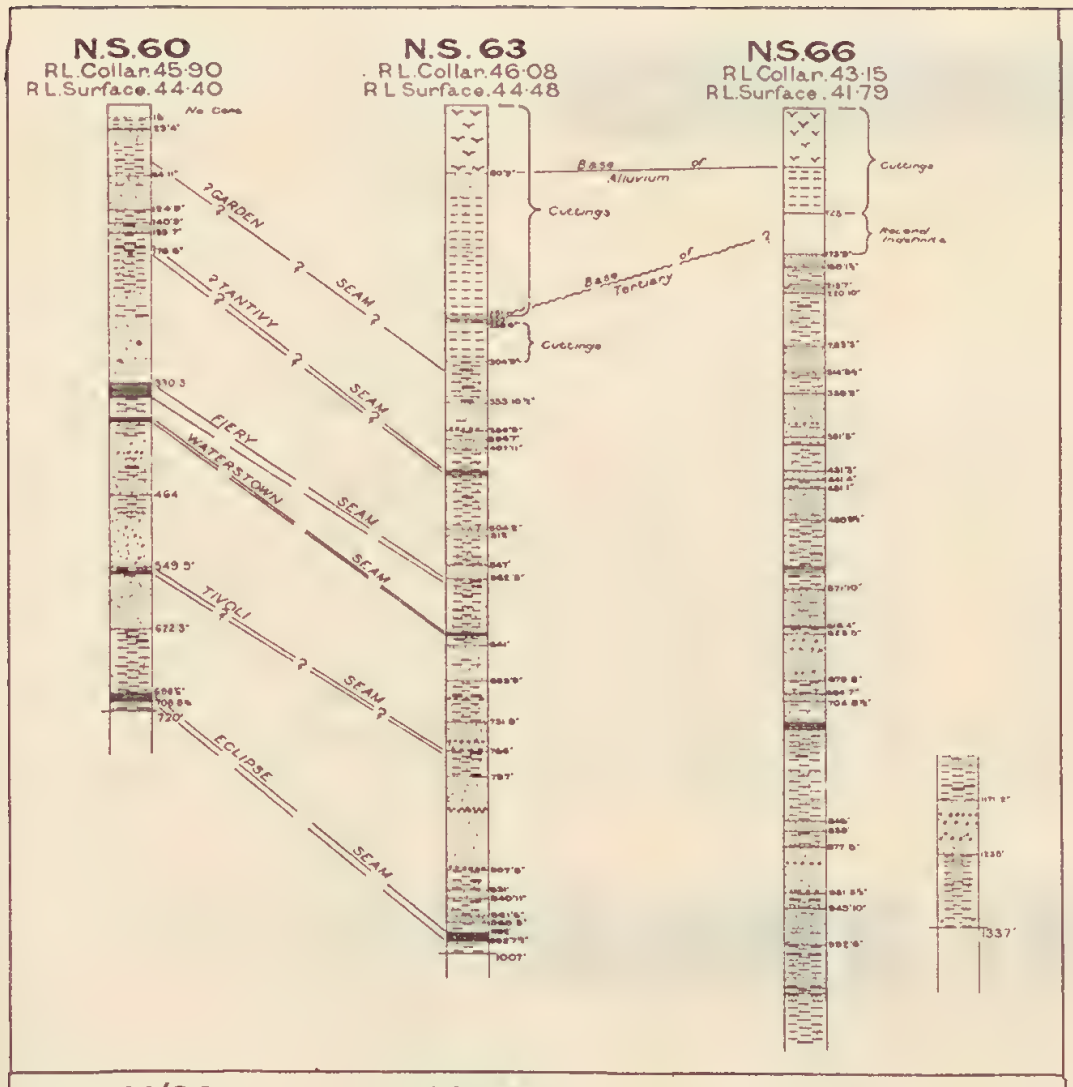


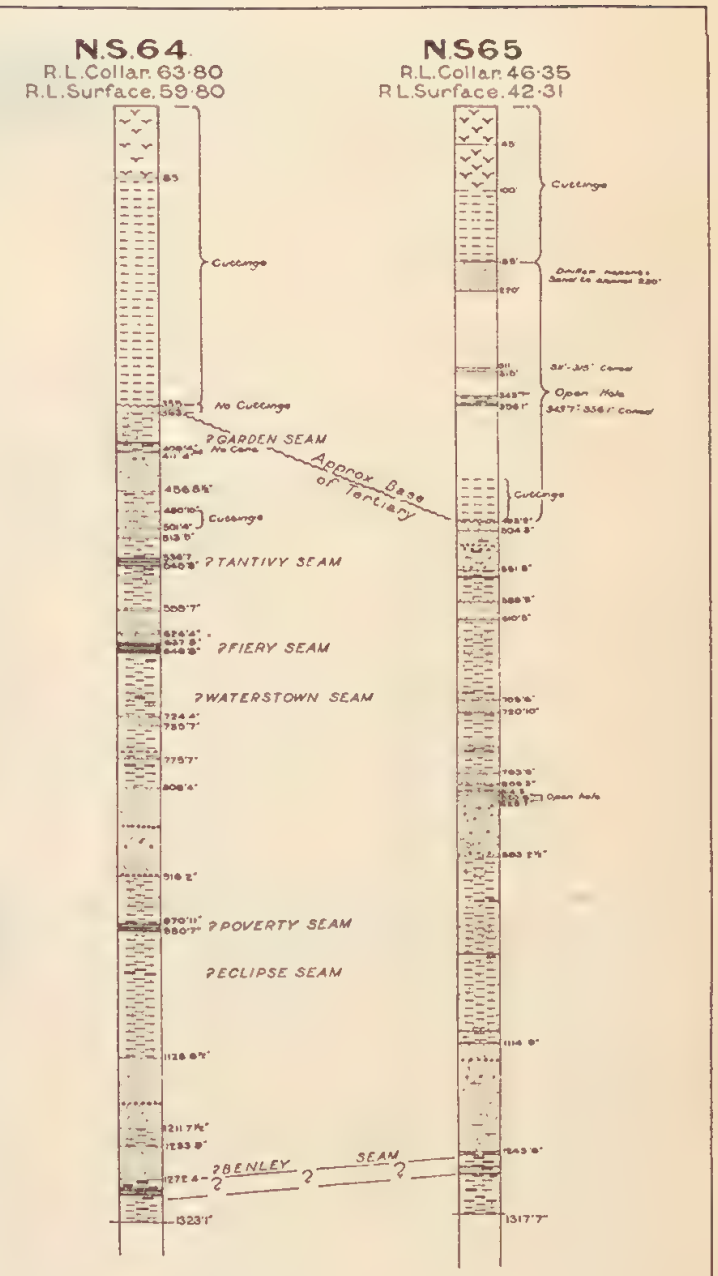
LEGEND

- Alluvium
- Mudstone. Claystone
- Shale
- Siltstone
- Sandstone
- Pebbly Sandstone
- Carb sh
- Coal
- Iron Carb
- Basaltic Sill
- Fault Zone

NE 25 5 1955

To accompany report by A.K.Denmead.M.Sc.





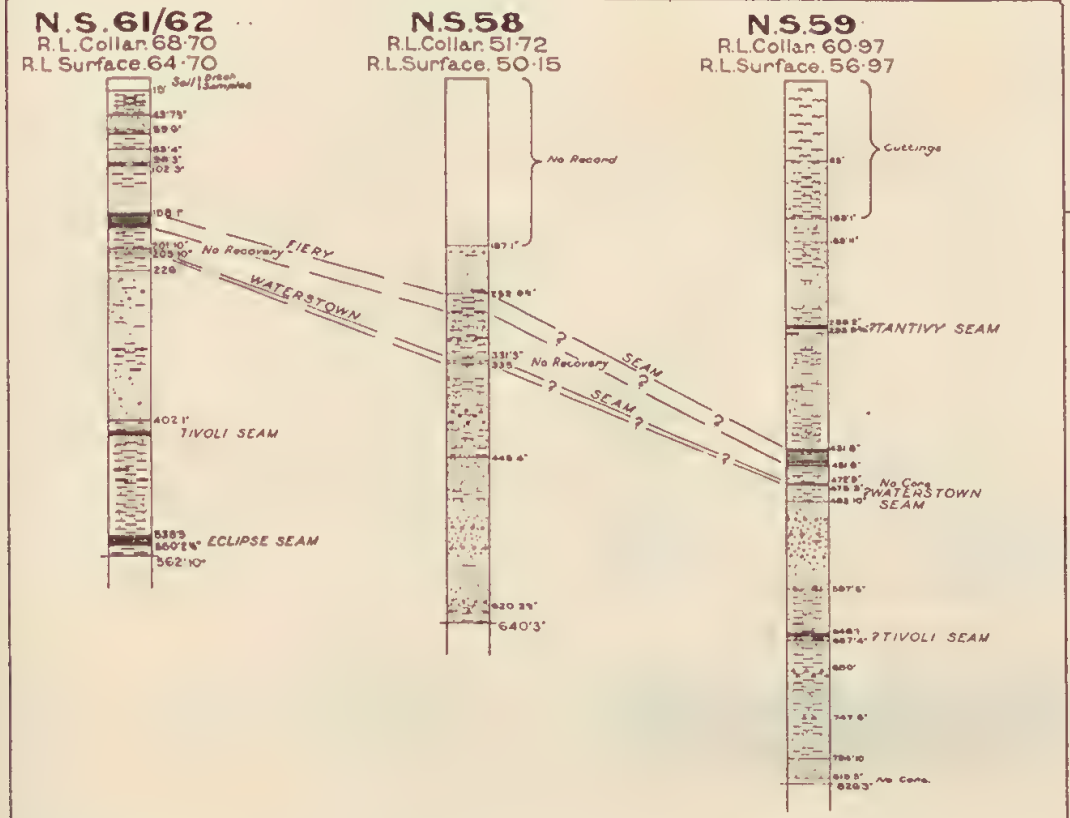


FIG 4

P.D.T.S. No.16 MINE AREA

ABERMAIN

GENERALISED BORE SECTIONS

Scale of Feet 100 0 100 200 300

LEGEND

Alluvium
Mudstone
Claystone
Shale
Siltstone
Sandstone

Pebbly sandstone
Carb sh.
Coal.
Iron Carb
Basaltic Sill
Fault Zone.

NE 24/55

To accompany report by A.K.Denmead, M.Sc

P.D.T.S. No. 16 MINE AREA **ABERMAIN** DIAGRAMS OF ECLIPSE SEAM DETAILS OF CORE RECOVERY AND ANALYSES

FIG.5

N.S.60

Proximate Analysis S.Cal Value & S G	Recovery per cent	Section Sampled
M% 1·5		
VM% 22·6		
FC% 37·0		
A% 38·9	71·6	
S% 0·28		
Joules/Gm 28380		
BTU/lb 8760		
S G 1625		

Seam Section

Description

ROOF: shale

698'6" — 4"(partly broken cone) inferior coal
6" dk grey sh
2" carb. sh with coaly lents & fusains
7" inferior coal with sh bands less than ½" thick
½" carb. sh with coaly lents
1'8" dk grey sh with coaly lents
700'8" — 2'8"(broken cone) inferior coal
6½"(partly broken cone) inferior coal, coal & shale.
2" dk grey sh
8"(partly broken cone) carb. sh.
702'7½" — 3" carb sh with coaly lents
11½"(broken cone) coal
3½" inferior coal with ½" sh band ½" from top
1"(broken cone) coal
1" carb. sh
½" carb sh with coaly lents
708' — 1" dk grey sh
1½"(broken cone) coal & inferior coal
2" dk grey sh with coal lents
4½"(partly broken cone) inferior coal with sh bands
½" dk grey sh
2½" carb sh with coaly lents
½" inferior coal ½" brown sh with coal lents
½"(partly broken cone) inferior coal
708 — 9" dk grey sh
1'7"(partly broken cone) coal & inferior coal
3½"(partly broken cone) coal & inferior coal
5½" grey sh
4¾"(partly broken cone) inferior coal with thin sh bands
708 8½" — ½" carb. sh with coaly lents
4" brown sh
½"(partly broken cone) inferior coal
1½"(broken cone) carb. sh. with coaly lents
708 2½" — FLOOR: dk grey sh

OVERALL RECOVERY 77·1%
698'6 to 709'2½"

N.S.61

Proximate Analysis S.Cal Value & S G	Recovery per cent	Section Sampled
M% 1·4		
VM% 22·4		
F.C% 31·5		
A% 44·7	56·5	
S% 0·20		
Joules/Gm. 17740		
B.T.U./lb 7630		
S G 1724		

Seam Section

Description

ROOF: coaly sh

537' 0" — 5" carb sh 5" fawn sh 5" inferior coal
5" carb sh 2½" fawn sh
10" carb. sh.
9" coaly sh 4½" fawn sh.
9" inferior coal 10" carb sh
3" inferior coal.
7½"(broken cone) coal, inferior coal & carb. sh
11"(partly broken cone) inferior coal with numerous sh bands less than ½" thick
541' 5" — ½" carb. sh ½" coal
1" carb. sh. with coaly lents
6" inferior coal
10½"(partly broken cone) coal with two 1½" sh bands
542'10" — 2½" carb sh. with coaly lents in top 1"
543' 4" — 8" fawn sh. 1½" carb. sh 8" inferior
1" carb. sh 8½" inferior coal, Bast.
2½"(partly broken cone) coal
4" carb sh with coaly lents
1'5½"(partly broken cone) inferior coal, coal & sh bands less than ½" thick
545'10" — ½" inferior coal
1" dk grey sh. ½" inferior coal
7"(partly broken cone) carb. sh with coaly lents
4" dk. grey sh.
3"(partly broken cone) coal
549' 6" — 1" carb sh
550' 2½" — 5½"(partly broken cone) inferior coal
½" fawn sh 2½" inferior coal
2"(broken cone) carb sh with coaly lents
550' 8" — ½" dk grey sh
2" inferior coal with thin sh bands in [laminae

FLOOR: Dk grey sh

OVERALL RECOVERY 63·4%
537'10" to 550'8"

N.S.63

Proximate Analysis S.Cal Value & S G.	Recovery per cent	Section Sampled
M% 1·5		
VM% 23·0		
F C% 39·1		
A% 36·4	93·2	
S% 0·32		
Joules/Gm. 21140		
BTU/lb. 9100		
S G 1591		
M% 1·5		
VM% 23·2		
F C% 34·6		
A% 40·7	98·0	
S% 0·30		
Joules/Gm. 19540		
BTU/lb. 8410		
S G. 1638		

Seam Section

Description

977'8½" — 3"(partly broken cone) dk grey sh showing traces running on bedding 5"
3½"(broken cone) coal with a noble carb. sh
1"(broken cone) dk grey sh
7½ maroon grey sh with ½" carb sh 2½" from [bottom
5" carb sh with coal lents
1'6"(partly broken cone) inferior coal & coal
4½" shaly coal
1" carb sh
5"(broken cone) brown sh & carb sh
3" light grey sh
1" carb sh
2½ broken cone) coal & inferior coal
2½"(partly broken cone) carb sh with coal
2½"(partly broken cone) inferior coal lents
2½"(broken cone) carb sh with coal lents
3" light grey sh
3" carb sh with a few brown sh bands less than ½" thick 1' from bottom
982 — 1'8"(broken cone) inferior coal & coal with a few thin sh bands up to ½" thick
983 6" — 6"(broken cone) coal & inferior coal
½"broken cone) carb sh
1½ grey sh
9" carb sh with coaly lents
3½"(broken cone) inferior coal & coal with thin carb sh bands up to ½" thick
½" carb sh with coaly lents 2" coal ½" shale
10"(broken cone) coal & inferior coal.
988 3½" — 3 carb sh. with irregular fawn sh bands ½" [thick
989 8" — 4"(broken cone) carb sh & coal
6½"(partly broken cone) coal
½" brown sh
1½" coal & inferior coal 5" carb sh.
2" inferior coal.
6"(partly broken cone) coal & inferior coal
2" dk grey sh
2½"(rather broken cone) coal & inferior coal.
½" dk grey sh. (lents)
1½"(partly broken cone) inferior coal
9" dk grey sh with coal lents
1'2¾"(broken cone) coal & inferior coal
993'7½" — 4½" carb sh. with numerous coal lenses & lents
998' — FLOOR: Carb sh & sh bands

OVERALL RECOVERY 97·3%
977'8½" to 993'

To accompany report by A K Denmead M.Sc

23655

P.D.T.S. No. 16 MINE AREA **ABERMAIN** DIAGRAMS OF MISCELLANEOUS SEAMS DETAILS OF CORE RECOVERY AND ANALYSES

FIG.6

N.S.64 BENLEY SEAM

Proximate Analysis S,Cal.Value & S.G. | Recovery per cent | Section Sampled | Seam Section | Description

M% 1.1
VM% 23.3
FC% 52.5
A% 23.1 — 82.3
S.G. 1.461

Enlarging 18" carb.sh at 1268'10½" to 1269'4½"

Composite sample of 1½" carb.sh at 1268'4½" 9" fawn sh at 1268'6½" 4" carb.sh at 1268'10½" 1" fawn sh at 1268'10½" 1½" carb.sh at 1269'4½"

A% 50.5
S.G. 1.807

OVERALL RECOVERY 78.7%
1272'4" to 1288'4"

1272'4" — ROOF Coal
8" dk grey sh with coaly lents 1" (broken core) ½" inferior coal (Light grey sh
4" dk grey sh with coaly lents 1" fawn sh.
½" inferior coal
5½" carb sh with coal lents
1'0" grey sh with irreg ½ coal lens 1" carb sh with ½" shaly coal ½" coal ½" carb sh (coal lents ½" inferior coal ½" dk grey sh & inferior coal
1'1" dk grey sh 1" coal
½" carbon with coaly lents
1'6" inferior coal 1'0" grey sh
½" carb sh with coal lents 1½" fawn sh
1'8" carb sh with ½ fawn sh at ¾" 1 inferior coal with carb sh lam 1" carb sh 1" coal 1'0" grey grad to brown sh with coal lents ½" inferior coal
1'2" carb sh with coal lents ½" brown sh (coal
½" carb sh ¾" coal 1 brown sh 1" inferior coal
1½" gray sh
2'4" (broken core) coal & inferior coal
2'7" carb sh with coaly lents
½" coal ½" dk grey sh with coal lents
2'3" (broken core) fawn sh
½" carb sh
1¼" (broken core) shaly coal
2'9" (broken core) carb sh with coal lents.
1281'4" — ½" dk grey sh 1½" fawn sh
1" inferior coal with brown sh parting in middle
1½" fawn sh
1¾" carb sh with coal lents
¾" fawn sh ½ carb sh with coal lents ¾" dk grey sh
1½" carb sh with coal lents & hence ½" shaly coal
2" carb sh with coal lents
1½" inferior coal with calc te laving
4½" carb sh
1282'8" — 3½" fawn sh 1½" carb sh with coal lents
1283'1" — 2'2" fawn sh granite
1283'10½" — 3½" (partly broken core) carb sh
1½" inferior coal with calcite laving
1½" carb sh with coal lents ¾" dk grey sh
1" carb sh
1½" carb sh 1½" carb sh ¾" brown sh
1" brown sh
1286'4" — 2½" (broken core) carb sh with coal lents
½" (broken core) fawn silestone
½" (broken core) carb sh
fawn sh
1287'4" — ½" carb sh with coal lents 1½" fawn sh
6" carb sh with coaly lents
1½" inferior coal
½" inferior coal
1288'4" — 8½" (partly broken core) coal & inferior coal
FLOOR: Sh, carb.sh. & thin coal bands

N.S.60 FIERY SEAM

Proximate Analysis S,Cal.Value & S.G. | Recovery per cent | Section Sampled | Seam Section | Description

M% 1.7
VM% 25.0
FC% 45.1
A% 28.2 — 93.8
S% 0.36
Joules/Gm. 24830
B.T.U/lb. 10680
S.G. 1.492

M% 1.7
VM% 25.4
FC% 46.3
A% 26.6 — 100
S% 0.32
Joules/Gm 25260
BTU/lb 10860
S.G. 1.485

Enlarging 3" sh with iron carb nodules 330'3" to 330'8" 2¾" dk grey sh with 1" fawn sh lent in bottom 1" at 330'8"

Composite sample of 3" sh with iron carb nodules as 330'3" 2¾" dk grey sh with fawn lent in bottom 1" at 340'8"

A% 69.2
S.G. 2.499

OVERALL RECOVERY 98.1%
330'3" to 347'

330'3" — ROOF sandstone
1½" (partly broken core) inferior coal with sh
½" dk grey sh 1" carb sh (lens
2¾" fawn sh
1½" inferior coal
1½" inferior coal with also sh band in middle
1" fawn sh with coal lents
2" coal & inferior coal 1½" coal with calcite laving
½" fawn sh
1¾" (broken core) inferior coal 1" fawn sh
1" shaly 8" inferior coal & coal
1'0" dk grey sh 1" inferior coal
1'8" dk grey sh 1¾" dk grey sh
½" (broken core) inferior coal
3" (partly broken core) shaly coal with ½
½" fawn sh ½" carb sh
332' — 1'2" (partly broken core) inferior coal & coal
½" ½ grey sh ½" carb sh.
3½" (partly broken core) inferior coal & coal
333 1½" — 5½" dk grey sh grading through fawn to buff
2'9" carb sh with a few sh lents
½" dk brown sh 1½" inferior coal
1½" fawn sh weathers with a few irregular carb. lents & thin bands
1" (broken core) coaly sh ½" dk grey sh
1" fawn sh ½" carb sh
6" fawn sh
6" inferior coal with sh parting 2" from top
1½" (partly broken core) inferior coal & coal
1½" (partly broken core) inferior coal & coal
1" carb sh ½" inferior coal ½" fawn sh
½" inferior coal ½" carb sh 1½" coaly sh
334 8½" — 1" inferior coal
½" carb sh ½" coaly sh
1" fawn sh with a few coal lents
½" coaly sh grading to inferior coal
1" fawn sh with carb sh lens
337' — 5½" (partly broken core) coal & inferior coal
3" sh with iron carb nodules; coal y lents 1" from top
338 6" — 4½" (broken core) coal & inferior coal
1" carb. sh. with a few fawn sh bands.
1" inferior coal
1½" (partly broken core) coal & inferior coal
1½" (partly broken core) coal & inferior coal
1" dk grey sh with fawn sh inset in bottom 1"
1" carb sh
10½" (broken core) coal & inferior coal
340 6" — 2" dk grey sh
5½" (broken core) coal & inferior coal
2½" dk grey sh
½" coal & inferior coal ½" fawn sh ½" coaly sh
½" inferior coal ½" dk grey sh ½" carb sh
½" coal & inferior coal
½" (broken core) coal & inferior coal ½" inferior coal
1½" carb sh 1½" dk grey sh
1" (coaly broken core) coal & inferior coal
341 10" — 5½" (partly broken core) coal & inferior coal
½" dk grey sh ½" coal & inferior coal
½" carb sh ½" inferior coal ½" carb sh
½" coal ½" inferior coal ½" carb sh
½" inferior coal ½" dk grey sh
½" coal & inferior coal
4" fawn sh with coal lents 1" from top
½" coal & inferior coal
½" dk grey sh with ½ coal lens 1" from top
½" coal & inferior coal
½" dk grey sh ½" inferior coal
½" (broken core) coal & inferior coal ½" dk grey sh
½" (partly broken core) coal & inferior coal
½" dk grey sh ½" coal & inferior coal
½" carb sh ½" dk grey sh ½" coal
½" inferior coal ½" dk grey sh ½" carb sh
½" coal & inferior coal
½" inferior coal ½" dk grey sh ½" carb sh
½" coal & inferior coal
½" (broken core) coal & inferior coal ½" dk grey sh
½" (partly broken core) coal & inferior coal
½" dk grey sh with ½ coal lens 1" from top
½" coal & inferior coal
½" dk grey sh ½" inferior coal
½" (broken core) coal & inferior coal ½" dk grey sh
½" (partly broken core) coal & inferior coal
½" dk grey sh ½" carb sh ½" coaly sh
347' — 8" dk grey sh with carb sh & coaly lents

N.S.61 FIERY SEAM

Proximate Analysis S,Cal.Value & S.G. | Recovery per cent | Section Sampled | Seam Section | Description

M% 1.4
VM% 25.6
FC% 46.8
A% 26.2 — 54.1
S% 0.33
Joules/Gm. 25330
B.T.U/lb. 10900
S.G. 1.479

OVERALL RECOVERY 64.8%
158'1" to 176'4½"

158'1" — ROOF: medium & coarse pebbly sandstone with 3" long grey sandstone with coal lents 1'6" 2'2" sh
2½" inferior coal & coal.
½" fawn sh
8" (partly broken core) coal with ½" inferior coal
1½" fawn sh with irregular coal lens 4" to 9" thick to 1'0" coal
2" inferior coal 2" fawn sh
½" coal ½" fawn sh ½" coal
½" carb sh ¾" coal
½" carb sh with coaly lens.
½" inferior coal with calcite laving
½" inferior coal
1½" (partly broken core) coal
½" carb sh with coaly lens ½" fawn sh
½" inferior coal ½" coaly sh lens
1½" fawn sh ½" carb sh with coal lens
1" coal grading into inferior coal
1½" coal ½" carb sh
(partly broken core) coal & inferior
(partly broken core) fawn sh coal
1" fawn sh ½" coaly lens
3" fawn sh 2½" coal & inferior coal
½" inferior coal ½" brown sh with coaly lens
4" (partly broken core) inferior coal
1" carb sh with fawn sh & coaly lens
1" fawn sh ½" coaly sh
2" dk grey sh with coal lens 2" from bottom
1" fawn sh ½" carb sh bottom
1" inferior coal with calcite laving & coal band in middle
½" fawn sh 1" carb. sh with coaly lens
1½" (partly broken core) inferior coal & 3" dk brown sh with coaly lens
½" carb sh 1½" dk grey sh lens sh
1" carb sh with coaly lens
1" inferior coal 3" carb sh with coaly coal with irregular fawn sh & coaly lens 2" from base
2½" fawn sh
1½" (partly broken core) inferior coal & carb sh
½" (broken core) fawn sh
½" carb sh
1½" inferior coal with calcite laving
½" dk grey sh ½" coaly lens
½" dk grey sh ½" bowlder
1½" dk grey sandstone with small inserts of iron carbonate & coaly lenses 1" from bottom
½" (broken core) coal (inferior lenses with coal lens 1" from bottom
½" (broken core) coal
1½" carb sh with coaly lens
1" carb sh with irregular fawn sh lenses 1" from bottom
2" buff sh
164'10" — 1'7½" (broken core) coal & inferior coal with 3" dk grey sh band approx 6" from bottom
169'4" — ½" dk grey sh with coaly lens
170'1½" — 6" (partly broken core) coal & inferior coal
173'4" — 3½" dk grey sh
½" inferior coal ½" carb sh
1½" grey sandstone
½" (broken core) coal & inferior coal
½" dk grey sh
174'2½" — 1½" dk grey sandstone with irregular coal & carb bands
½" (broken core) coal with shale band in middle
½" inferior coal ½" fawn sh 3½" inferior coal ½" fawn sh 1½" dk grey sh
½" inferior coal ½" dk grey sh & inferior coal 1½" dk grey sh
½" dk grey sh with coaly lens
175'4" — ½" inferior coal ½" dk grey sh ½" inferior coal
176'4½" — dk grey sh with coaly lens
FLOOR: dk grey sh with coaly lens

N.S.60 TIVOLI SEAM

Proximate Analysis S.Cal Value & SG | Recovery per cent | Sampled | Seam Section | Description

M% 1.4
VM% 25.6
FC% 43.9
A% 29.1 — 84.9
S% 0.35
Joules/Gm. 24320
BTU/lb 10460
S.G. 1.509

Enlarging 5½" dk grey sandstone with coaly lents in top 1"

OVERALL RECOVERY 85.9%
549'3" to 560'6"

549'3" — 6" coarse white pebbly sandstone
½" carb sh with coal lents ½" fawn sh
1½" coal & inferior coal 1" carb sh
2" sh ironstone ½" coaly sh
1" fawn sh
½" fawn sh with coal lents
½" carb sh
½" (partly broken core) inferior coal
1½" carb sh ½" inferior coal ½" carb sh
1" coal ½" inferior coal
1½" dk grey sh
1" brown sh ½" carb sh
1½" carb sh with 5" lens of brown sh ½" from top coaly sh 1" dk grey sh ½ sh ironstone bottom
2½" carb sh with irregular fawn sh bands
1½" inferior coal 4½" carb sh with coaly lents
553'6¾" — 1½" (partly broken core) inferior coal & coaly sh
½" carb sh 1" inferior coal
1½" (broken core) coal with a few thin sh partings
554'3" — 5½" (broken core) coal with a few thin sh partings
2½" dk ironstone ½" carb sh with coal lents
1'1½" (partly broken core) coal & inferior coal
1'8" dk grey sh ½" inferior coal
5½" dk grey sandstone with coaly lents in top 1" 1½" (broken core) inferior coal ½" carb sh
7½" (broken core) coal & inferior coal
2" inferior coal
½" dk grey sh
1'6½" (partly broken core) inferior coal, coal & carb
559'3" — 5½" (broken core) coal
560'1" — 1½" brown sh
560'6" — 3½" (partly broken core) dk grey sh

N.S.60 WATERSTOWN SEAM

Proximate Analysis S.Cal Value & SG | Recovery per cent | Sampled | Seam Section | Description

M% 1.4
VM% 29.6
FC% 54.0
A% 15.0 — 69.6
S% 0.44
Joules/Gm 29820
BTU/lb. 12830
S.G. 1.374

Enlarging 1½" dk grey sh at 372'7½" 1½" dk grey sh at 372'9½"

Composite sample of 1½" dk grey sh at 372'6½" 1½ sh grey sh at 372'9½"

A% 78.8
S.G. 2.341

OVERALL RECOVERY 80.8%
371' to 376'2½"

371' — ROOF: Sa. grad to sh in bottom 3½"
1½" carb sh
3" (partly broken core) inferior coal and carb sh with coaly lents
½" fawn sh 1½" carb sh 1½" fawn sh
½" carb sh 1" fawn sh 1" carb sh
2½" (broken core) coal with a few sh
1'0" dk grey sh
2½" (broken core) coal
½" inferior coal 1½" dk grey sh
6" inferior coal
371' 10¾" — 1'7½" (partly broken core) coal & inferior coal
½" carb sh ½" inferior coal ½" carb sh
2" dk grey sh with coal bands at base
3½" dk grey sandstone with irregular fine grey sandstone band from 3 coal
½" shaly fine white sandstone 1" from top 1½" dk grey sandstone with coaly fine sandstone laminae & a few coal lents
375'0¼" — 2'7½" dk grey sh with coal lents
376'2½"

N.S.63 WATERSTOWN SEAM

Proximate Analysis S,Cal.Value & S.G. | Recovery per cent | Sampled | Seam Section | Description

M% 1.5
VM% 28.8
FC% 52.1
A% 17.6 — 100
S% 0.43
Joules/Gm. 28550
BTU/lb. 12280
S.G. 1.403

Enlarging 1" brown sh at 624'6"

Sample of 1" brown sh with coaly & carb lents
A% 68.5
S.G. 2.075

OVERALL RECOVERY 89.3%
624'6" to 635'3"

624'6" — 1'3½" dk grey sh.
½" brown sh with coal lents 1½" fawn sh ½" inferior coal.
1½" (broken core) carb sh with coal lents
627'3" — 6" carb. sh. with coaly lents in bottom 2" 8" inferior coal 1½" dk grey sh.
627'8½" — 1'8½" (partly broken core) coal
½" brown sh
2" (partly broken core) coal
1" brown sh. with coaly lents
630'1¾" — 7½" (coarsely broken core) coal
½" bowlder
630'3" — 2½" dk grey sandstone with coaly lents
7" grey sh
6½" grey sh showing fracturing (cassette lent)
6" fine grey sandstone
1" carb sh with coaly lents
6" bowlder
10" dk grey sh
½ brown sh
4½" (broken core) coal
6½" dk grey sh grading to fawn.
1½" carb sh
4" (partly broken core) coal & inferior coal
1'0½" grey sh
2½" (partly broken core) inferior coal with thin 1" dk shale
635'3" — 3" dk grey sh with coaly lents

To accompany report by A.K. Denmead M.Sc

P3 6.55

ABERMAIN MINE AREA. IPSWICH COALFIELD SEAM SECTIONS TAKEN IN MINE WORKINGS

Note:—For positions of sections in Mine Workings See Plan Fig. 1.

FIG. 7

FIERY SEAM

Seam Section

Description

Section F.S.1

Roof. Med-co sa

3½"coal with carb. sh. partings
1"coaly sh. 1"bluey 2"sh & coal
1¾"fawn sh 2¼coal & bluey ½"fawn sh
1"coal & bluey 6"interbed. fawn & dk gy sh. & bluey with few thin coal bands.
1"fawn sh. ½"coal 1¼"fawn sh. ½"coal
3¼"fawn sh ¾"bluey 2⅛"fawn sh with ½"coal. ½"fawn sh ½"bluey [coal lents
¾"fawn sh 1¼"bluey & coal 3½"fawn sh
1"coal 1"fawn sh 2"bluey with coal lens
1"fawn sh 6¼"coal 4"fawn sh [in top 1"
½"coal 2"dk gy sh ¼"bluey 1½"coal & bluey
½"fawn sh 2"bluey 1"fawn sh
7"coal & bluey
¾"fawn sh 4½"coal
4½"fawn sh ½"carb sh with coal lents
½"fawn sh ¾"bluey 4"coal
2¾"fawn sh ½"carb sh with coal lents
½"fawn sh 1½"bluey 1½"fawn sh 1½"coal
1½"dk gy sh 1"fawn sh 1"coal
1¾"coal with sh partings 6"coal & bluey.
½"fawn sh 1"coal & bluey 2½"fawn sh
7½"bluey with sh partings
2½"fawn sh 3"bluey & coal
½"fawn sh 3"bluey & coal

1'0¾" coal
1½"fawn sh
6"coal & bluey with sh partings.
1¾"carb sh. with coal lents.

11"coal with sh partings
4"fawn sh.
2½"coal. 1½"fawn sh.

1'1¾"coal.

6"fawn sh.

8½"bluey with coal bands
2"coal. 1"fawn sh

8½"bluey & coal bands with fawn sh
2"fawn sh. [partings
7½"interbed sh. & coal.

7"coal & bluey
2"fawn sh 1"bluey & coal ½"fawn sh.
1"bluey. ½"fawn sh. 1"coal ½"fawn sh 1"coal
4"gy sh ½"coal
3½"gy sh ½"coal ½"gy sh 1½"coal.
½"fawn sh 3½"coal with dk gy sh laminae
1½"dk gy sh with coal lents 5½"fawn sh
1½"bluey 2"coal ½"fawn sh. 2"coal

3½"bluey
6½"carb sh with coal lents grading to [dk gy sh.

Floor light gy sh grading to siltstn

Overall Height · 21'9½"

Proxmate Analysis S.Cal Value & S.G

Section Sampled

Section F.S.1

M%	1·3
VM%	26·9
FC%	41·6
A%	30·2
S%	0·30
Joules/Gm.	22630
BTU/lb.	9740
S.G.	1·519

Height of Sample: 6'5½"

Section F.S.2

M%	1·2
VM%	28·4
FC%	43·3
A.%	27·1
S%	0·27
Joules/Gm.	24650
B.T.U./lb	10610
S.G.	1·514

NE 24/55

ECLIPSE SEAM

Seam Section

Description

"Dirty Tops" above sample

Roof. Coaly sh.

2½"coal with few sh bands.
½"brown sh. 3"inf. coal.
7"coal
¼"sh. 1½"coal 1¼"dk gy sh with coal lents
4½"coal. 1¾"sh with coal lents
5"coal.
1¾"boulder (lent). ½"brown sh. 1½"coal.
¾"brown sh 1½"coal. 1"brown sh.
6½"coal. ¼"sh.
2½"coal ½"sh. 1"coal (variable). ½"sh & coal.
6½"coal
1¾"boulder. 1½ coal.
1½"brown sh 1½"coal 2"brown sh
1½"dull coal. ¾"brown sh.
7"coal. ½"sh
2'coal 1"brown sh. 1½"coal. ¼"sh.
6"coal

Floor. sh

"Dirty Bottoms"

Proxmate Analysis S.Cal.Value & S.G.

Section Sampled

Section E.S.2

"Dirty Tops" above sample

2'carb sh. with light gy sh laminae

1'8½"coal.

1½"bluey
8½"coal
1"med gy sh.
1½"coal 1"med gy sh 1½"coal & bluey
1"med gy sh 1"inf coal.

1'8½"coal

1½"med gy sh. 1½"coal
3"med gy sh (lent"). 1½"coal
1½"med gy. sh
8½"coal.
2½"med gy sh
8"coal with sh partings
1"carb sh. 1½"coal.

Floor. light gy. sh.

Overall Height: 7'6".

WATERSTOWN SEAM

Seam Section

Description

Section W.S.1

M%	1·5
VM%	28·4
FC%	41·4
A%	28·7
S%	0·45
Joules/Gm	22780
BTU/lb	9800
S.G.	1·547

Excl.

Height of Sample 3'7½".

Roof. sandstone.

3"fawn sh. 2"dk gy sh
3"bluey.
1'7"coal with sh. partings, & with ½"med. gy. sh bands at 2"& 3½" from top. & ¾"med gy sh 1'1" from top.
1½"med. gy sh with few coal lents.

10½"coal.
8"sh. (lent")
5"coal.
2'fawn siltstn. & boulder (lent")
7"coal with sh. & bluey partings

Floor. light gy sh

TIVOLI SEAM

Seam Section

Description

Section T.S.1

Roof. Med gy sh
2½"fawn sh. 1½"bluey.
5"coal.
3½"brown sh with few thin bluey bands
2"coal. ¾"brown sh. ¾"coal
10'dk gy sh with coal lents. in top 2".

6"bluey.

9"coal
1½"dk gy sh with coal lents
4½"bluey
6"coal.
2'dk gy sh. 1"coal. 3½"brown sh.
2"coal ½"sh
3"coal with sh partings.
11"sh with thin coal bands in btm 6".

Floor: Med gy. siltstn

Overall Height: 6'5"

To accompany report by A.K. Denmead, M.Sc

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 283

SUMMARY REPORT
IRON ORE RESOURCES OF QUEENSLAND

By
J. H. BROOKS, B.Sc., Geologist

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SUMMARY REPORT

IRON ORE RESOURCES OF QUEENSLAND

By J. H. Brooks, B.Sc., Geologist.

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A summary report on the Iron Ore Resources of Queensland, compiled by Mr. J. H. Brooks, Geologist. Apart from a few extremely brief summaries which have been published from time to time (the latest in 1930) no general report on the State's iron ore resources has been published.

In the period 1953-54 the Geological Survey undertook to make an assessment of the State's iron ore resources for the information of a Committee appointed to investigate the establishment of steel works in Queensland. A number of deposits in Northern and North-Western Queensland in regard to which existing reports were inconclusive or conflicting, were inspected. As a result of such inspections, coupled with a review of all the relevant literature, it is now possible to present an authoritative and up-to-date summary of the State's iron ore deposits.

It is revealed that there are no known deposits suitable for exploitation as raw material for steel production. There are bedded deposits in the Musselbrook Creek area south-west of Burketown which, though of low average grade, are believed to be extensive. The Mount Philip deposit in the Cloncurry area, while of moderate size, has to be ruled out because of its high silica content and remote situation.

Total reserves in deposits for which estimates are available (18 in number) are less than ten million tons, while total reserves in all known deposits are not expected to exceed twelve million tons. One deposit contains over four million tons, one contains between two million and four million tons, three contain half a million tons and thirteen less than half a million tons.

The greatest concentration of iron ore deposits and the largest deposits occur in the Precambrian rocks of the Cloncurry Mineral Field, the centre of which is 481 miles by rail from the nearest deep-water port. In the coastal areas, the majority of the deposits are of the contact-metasomatic type and while sometimes containing ore of considerable purity, are always quite small.

The report is accompanied by a locality map.

—A.K.D.

Introduction.—This report summarises the available data on the iron ore deposits of Queensland and in particular incorporates information obtained from a number of Departmental investigations in Northern and North-Western Queensland in the 1953-1954 period. These investigations did much to clarify the position with regard to deposits which had previously been the subject of only brief or inconclusive geological examinations.

Numerous occurrences of iron ore have been known in Queensland since early days of mining exploration. This may be attributed to the fact that iron ores are characteristically conspicuous in outcrop due to the resistant nature of the iron minerals relative to the surrounding country rocks. Early investigators were optimistic regarding the potentialities of some of these deposits, but subsequent closer examination has so far failed to indicate the existence of any large, high-grade orebody which is suitably situated in regard to transport and coal resources.

The largest known deposit occurs in the Cloncurry Mineral Field at Mount Philp. Even here the reserves are estimated in millions of tons whereas for an adequate source of supply for an iron and steel industry, reserves of the order of tens or hundreds of millions of tons would be necessary. In addition, this deposit is so remote from the sea coast and coal supplies that it can be discounted from serious consideration on this score alone.

Of the more accessible deposits along the coastal belt, those at Iron Range and Iron Island were at one time thought to have prospects of providing adequate supplies of iron ore. However, a detailed survey of the Iron Range deposit showed that there are no appreciable reserves of high-grade ore. Nearly 400,000 tons of ironstone flux were mined at Iron Island for use by Mount Morgan Gold Mining Co. Ltd. When operations ceased in 1921, testing by the company indicated that reserves above high-water mark were insignificant. A large number of high-grade deposits of the contact-metasomatic type occur in the coastal belt from Herberton to Gladstone, but deposits of this type are of relatively small size and erratic nature. None of these deposits can be expected to supply a large quantity of iron ore.

Due to the fact that iron ores are normally conspicuous in outcrop, it is unlikely that further conventional geological exploration would be successful in discovering new deposits of significance. Geophysical exploration using an airborne magnetometer has been successful in some cases in locating concealed bodies of ironstone in other parts of Australia and the world. Magnetometer exploration work in Queensland has been of a limited nature. A survey of the Iron Range area was carried out by the Aerial Geological and Geophysical Survey of Northern Australia in 1936, but this work was directed towards elucidating the geological structure in relation to gold mineralisation and did not cover the main occurrences of iron ore. It is possible that magnetometer work, directed to selected favourable areas, could lead to the discovery of non-outcropping bodies of iron ore.

SUMMARY OF DATA ON INDIVIDUAL DEPOSITS.

A. North-Western Queensland.

1. *Mount Philp.*

Location and Access.—The deposit is located 48 miles south-west of Cloncurry and 2·5 miles south of the abandoned mining centre of Ballara. The

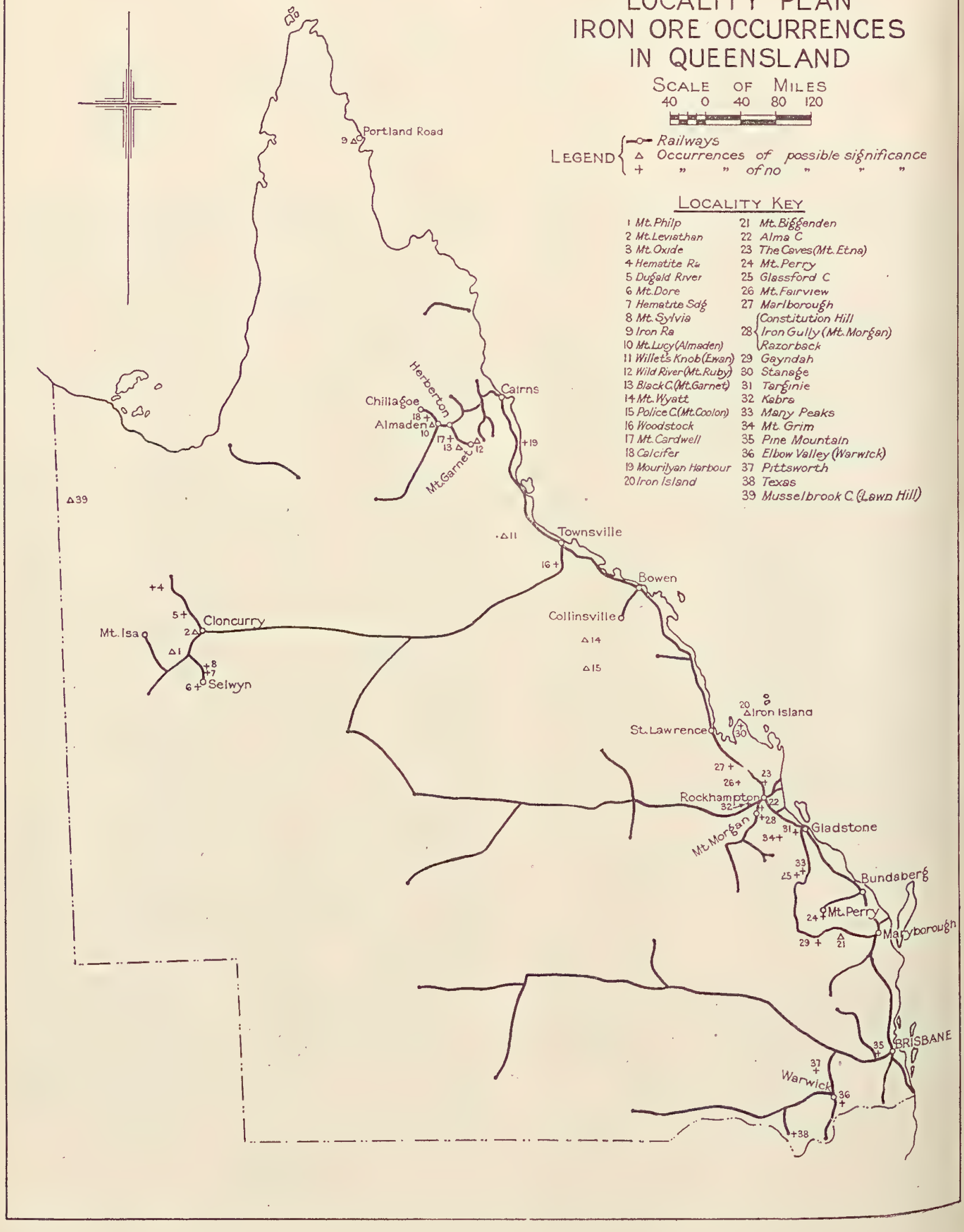
LOCALITY PLAN
IRON ORE OCCURRENCES
IN QUEENSLAND

SCALE OF MILES
40 0 40 80 120

LEGEND
- Railways
- △ Occurrences of possible significance
- \+ " " of no " " "

LOCALITY KEY

1 Mt. Philp
2 Mt. Leviathan
3 Mt. Oxide
4 Hematite Rs
5 Dugald River
6 Mt. Dore
7 Hematite Sdg
8 Mt. Sylvia
9 Iron Rs
10 Mt. Lucy (Almaden)
11 Willet's Knob (Ewan)
12 Wild River (Mt. Ruby)
13 Black C. (Mt. Garnet)
14 Mt. Wyatt
15 Police C. (Mt. Coolon)
16 Woodstock
17 Mt. Cardwell
18 Calcifer
19 Mourilyan Harbour
20 Iron Island
21 Mt. Biggenden
22 Alma C
23 The Caves (Mt. Etna)
24 Mt. Perry
25 Glassford C
26 Mt. Fairview
27 Marlborough
28 Constitution Hill / Iron Gully (Mt. Morgan) / Razorback
29 Gayndah
30 Stanage
31 Targinie
32 Kabra
33 Many Peaks
34 Mt. Grim
35 Pine Mountain
36 Elbow Valley (Warwick)
37 Pittsworth
38 Texas
39 Musselbrook C. (Lawn Hill)



nearest railhead is Devoncourt, 27 miles by vehicle track from Mount Philp. Devoncourt is on the Townsville-Mount Isa railway, 521 miles from Townsville. A railway line previously connected Devoncourt to Ballara but the rails have been removed.

Description.—The ironstone forms a prominent ridge 2·1 miles long and of average width 85 ft. It occurs in rough, arid country near the headwaters of the Malbon River. The peak of Mount Philp rises 600 ft. above creek level and the ironstone would be amenable to large scale, bulk mining methods.

Geology.—The ore consists of granular hematite and a small variable amount of magnetite. Quartz, the principal impurity occurs as fine grains even in the highest-grade sections. In the lower-grade sections quartz also occurs in vein form and in partly replaced hematite quartzite bands. In general, the grade deteriorates along the strike from north to south. The deposit is associated with a major fault and the ironstone replaces altered Precambrian calcareous and arenaceous sediments.

Size and Grade.—After a plane table survey and systematic sampling in 1953 the following data were compiled (Carter and Brooks, 1955):—

Total exposed ironstone: 4,110,000 tons averaging 36·6 per cent. iron and approximately 46 per cent. silica;

Exposed ironstone in northern section: 2,750,000 tons averaging 46·9 per cent. iron and approximately 31 per cent. silica, including 1,107,000 tons containing more than 50 per cent. iron;

Tons of ore per vertical ft. averaging 41·8 iron=105,000;

Tons of ore per vertical ft. averaging 48·5 iron = 71,000.

The following impurities occur:—Titanium 0·13-0·43 per cent., Manganese 0·005-0·019 per cent., Phosphorus 0·02-0·05 per cent., Sulphur Trace-0·016 per cent. As the silica is, to a large extent, finely intermixed with hematite, it is very doubtful if beneficiation of the ore could be successfully carried out. The deposit is of significant size and the largest so far investigated in Queensland. However, the remote location and the comparatively low-grade preclude serious consideration as a source of iron ore under existing economic conditions.

2. *Mount Leviathan (Black Mountain).*

Location and Access.—Mount Leviathan is situated two miles south-west of Cloncurry which is 481 miles by rail from Townsville. The railway line passes a quarter of a mile from the deposit.

Description and Geology.—The mountain rises 270 ft. above the plain of the Cloncurry River and forms a prominent ridge. It occurs along a line of faulting in altered calcareous sediments and basic igneous rocks. The ironstone consists of granular hematite and subordinate magnetite with some finely granular quartz and quartz veins.

Size and Grade.—The latest estimate of ore (Carter, 1955) places the amount of ore above the general surface level at 500,000 tons. No detailed mapping or sampling of the deposit has been carried out. Two samples made up of chips taken all over the deposit but excluding quartz veins averaged 58·5 per cent. iron and 14·4 per cent. silica. The average iron content of the deposit would be somewhat below this figure. The phosphorus content of samples was 0·07 per cent. and sulphur content 0·006-0·05 per cent.

The deposit is better situated in regard to railway transport than Mount Philp but the reserves are small.

A similar but much smaller deposit occurs at Mount Pisa one mile south of Cloncurry.

3. *Mount Oxide.*

Location and Access.—Mount Oxide is located 104 miles by vehicle track north of Mount Isa which is 603 miles by rail from Townsville.

Description and Geology.—The deposit occurs as a replacement of sandy shales on the hanging-wall of the Mount Oxide fault. The Mount Oxide copper ore body occurs adjacent on the foot-wall side of the fault. The outcrop of iron ore which consists of limonite and hematite is considered by Blanchard (1939) to be the product of normal oxidation of an ironstone body rather than a gossan resulting from the oxidation of a copper-iron sulphide body. The deposit is roughly 1,000 ft. long and 100 ft. wide and rises over 200 ft. above creek level. These dimensions indicate that 2½ million tons of ore may be present above creek level. A representative sample taken by Ball (1907) assayed 51·3 per cent. iron, 15·9 per cent. silica, 0·46 per cent. sulphur, 0·08 per cent. phosphorus. A sample taken over a width of 44 ft. in the 208-ft. level adit by Blanchard (1939) assayed 51·0 per cent. iron and 13·0 per cent. silica.

The location of the deposit is too remote to warrant any consideration as a source of iron ore.

4. *Hematite Range (Lochness).*

Location and Access.—The deposit occurs 80 miles north-west of Cloncurry. It is nearly 30 miles in a direct line from the nearest rail head, Kajabbi, which is on the Cloncurry-Dobbyn branch line.

Description and Geology.—The deposit consists of two parallel replacement bodies in limestone. A chip sample from the eastern outcrop assayed 44·8 per cent. iron and 0·21 per cent. phosphorus. No detailed mapping or sampling has been carried out but from an examination of air photos it is considered very doubtful if earlier estimates of 10 to 20 million tons of ore above plain level (Jensen, 1941) could be substantiated.

The location is too remote to warrant further consideration of the deposit.

5. *Musselbrook Creek (Lawn Hill).*

Location and Access.—The deposit is located near the Northern Territory border approximately 100 miles south-west of Burketown. Access to the deposit is difficult and is at present obtained by vehicle track from Camooweal via Highland Plains station.

Description and Geology.—The deposit is of sedimentary origin and occurs as two beds of ferruginous sandstone in a succession of sandstone, siltstone, and shale of Upper Proterozoic age. The ferruginous beds range up to 30 ft. in thickness and are separated by up to 200 ft. of quartz sandstone. The highest-grade material consists of limonite and goethite and commonly has concentric, columnar concretions of iron oxides. A specimen of this type of material assayed 49·1 per cent. iron*. The average grade is much lower than this figure and is certainly sub-economic unless beneficiation is practicable. The beds are persistent over a strike length of some miles and the available tonnage may be quite large. Investigations are at present in progress to provide precise data on the size and grade of the deposit.

Other Occurrences of Iron Ore in the Cloncurry Mineral Field.

Several small replacement bodies of hematite occur west of the Mount Dore-Mount Cobalt area and about 10 miles south-west of the railhead at Selwyn. At Hematite siding (abandoned) on the Selwyn branch line approximately 30,000 tons of ironstone consisting of limonite and hematite were mined for use as flux at the Mount Elliott smelters. At Mount Sylvia, 1½ miles south-east of Kuridala on the Selwyn branch line, a narrow body of hematite quartzite occurs. A small body of magnetite occurs 6 miles south-east of the Dugald River lead-zinc prospect which is 40 miles north-west of Cloncurry. It is stated to be 2,200 ft. long and 120 ft. wide (Sturmfels, 1952) but no assay data are available. This may be the deposit referred to by Ball (1907) as the Palmtree deposit. None of these deposits is of significance as a source of iron ore.

B. Cape York Peninsula.

Iron Range.

Location and Access.—The deposit is situated 17 miles by vehicle track from Portland Road, the port on Weymouth Bay. The port is roughly 600 miles by sea from Bowen.

Description.—The deposit is situated on a low range 5 miles in length. The highest point, Lamond Hill, rises 622 ft. above sea level. The topography is rough and the hill slopes are covered with rain forest.

Geology.—The ironstone consists of hematite usually micaceous in form, and some magnetite. It occurs as lenticular bodies replacing slates which are interbedded with mica schist. Silicification and quartz veining is frequent.

Size and Grade.—A detailed chain and compass survey and systematic sampling were carried out in 1953 (Levingston, 1954). The deposit consists of a number of small, discontinuous bodies of hematite, the largest of which (on Lamond Hill) extends for 500 ft. along the strike and is of narrow but indefinite width. Soil and vegetation obscure the detailed extent of the deposit but the lenses of ore are not of significant size and the deposit as a whole would not lend itself to large-scale mining operations. The normal type of ore averages 45 per cent. iron and 30 per cent. silica. The deposits on Lamond Hill average 48 per cent. iron and 25 per cent. silica and represent the best section of the Iron Range deposits.

Though the deposit is favourably situated regarding access it is neither large nor high-grade and cannot be considered as a major source of iron ore.

*(K. J. Lovering, National University, Canberra.)

C. Northern Coastal Queensland.

1. *Mount Lucy (Almaden).*

Location and Access.—The deposit is situated 3 miles west of Almaden which is 121 miles by rail from Cairns.

Description and Geology.—Mount Lucy rises 150 ft. above the general surface level and the ironstone forms a relatively thin capping on the hill. The ore consists of maghemite (magnetic ferric oxide), magnetite, and some limonite. It is associated with garnet rock and granite, and is a contact-metasomatic type of deposit.

Size and Grade.—Dunstan (1905) reported that the ironstone was 700 ft. long, 50 ft. wide, and 50 ft. deep and estimated reserves at 250,000 tons *in situ* and 100,000 tons in the scree. One sample assayed 68·5 per cent. iron and 0·57 per cent. silica. Up to 1931, 16,326 tons of ore were used as flux at the Chillagoe smelter. From 1931 till the smelters closed down in 1943 34,483 tons of ironstone flux were obtained from the Chillagoe district, much of which is believed to have been obtained from Mount Lucy.

The ore is high in grade but the reserves are not significant.

2. *Willet's Knob (Ewan).*

Location and Access.—The deposit is situated 3 miles north of Ewan which is 55 miles by road from the North Coast Railway line at Moongobulla. Moongobulla is 39 miles by rail from Townsville.

Description and Geology.—The ironstone occurs as three small, irregular outcrops and the remainder of the ridge is covered with magnetite scree. The ore consists of magnetite and is associated with garnet on the contact of limestone with granite. It is a contact-metasomatic type of deposit.

Size and Grade.—Levingston (1954) estimated reserves at 200,000 tons to the limit of quarrying operations. A chip sample taken by J. H. Reid (1931) assayed 66·5 per cent. iron. The largest deposit is of very pure magnetite but the others contain garnet and would be of lower grade.

Iron Mountain (Mount Moss) is located 30 chains north-east of Willet's Knob. It is described by Reid (1931) as "a high knob consisting of siliceous contact rocks with staining and facing of iron oxides. Magnetic iron ore is very subordinate compared to some of the other knobs, such as Willet's." The outcrop is highly garnetiferous and contains small quantities of copper, lead, zinc, and arsenic minerals.

3. *Wild River.*

Location and Access.—The Western deposit occurs 7½ miles north-north-east of Innot Hot Springs, and the Mount Ruby deposit 9 miles north-north-east of Innot. Innot is 24 miles by road from Herberton which is 82 miles by rail from Cairns.

(*i.*) *Western Deposit—*

Description and Geology.—Small, disconnected lenses occur over a strike length of one mile. Massive hematite and crystalline magnetite are associated with garnet which in places becomes predominant. The deposit occurs in metamorphosed sediments on a granite contact and is of the contact-metasomatic type.

Size and Grade.—The largest ironstone lens is 230 ft. long and 25 ft. wide. Connah (1954) estimated reserves at 70,000-80,000 tons to the probable limit of quarrying operations. Even to extract this ore a large quantity of waste would have to be removed. The average of nine samples was 54·6 per cent. iron and 6·1 per cent. silica. The iron minerals have a greater resistance to weathering than the garnet, and the grade indicated from surface sampling may be higher than the true average.

(*ii.*) *Mount Ruby—*

This is similar to the Western deposit. The hill rises 50 ft. above the general surface level.

Size and Grade.—The main deposit is an elongate, irregular body 300 ft. long and 30 ft. to 60 ft. wide. The average of three samples from the surface gave 54·1 per cent. iron and 6·7 per cent. silica. The average of three samples from dumps at two old prospecting shafts and a sample taken from the surface to a depth of 5 ft. in the shaft gave 37·1 per cent. iron and 21·7 per cent. silica. This indicates the deterioration in grade with depth. Connah (1954) estimated the maximum reserves to the limit of quarrying operations to be 80,000 tons.

4. *Black Creek (Mount Garnet).*

Location and Access.—The deposit is situated 8 miles west of Mount Garnet, and 4 miles south-west of Nymbool railway siding which is 129 miles by rail from Cairns.

Description and Geology.—The ironstone, which consists of hematite, forms small disconnected lenses. It is associated with quartzite in an area occupied largely by granite and the deposit is of the contact-metasomatic type.

Size and Grade.—The ore lenses aggregate 2,625 tons per vertical foot and the vertical range for quarrying operations is 40 ft. Connah (1955) estimated reserves at 105,000 tons. Quarrying operations would involve the removal of possibly a million tons of waste rock. The average of eight samples gave 57·3 per cent. iron and 10·9 per cent. silica.

Another deposit of a similar type but very much smaller occurs 6 miles south-west of Mount Garnet.

5. *Police Creek (Mount Coolon).*

Location and Access.—The deposit is situated 2 miles west of Mount Coolon which is 85 miles by road from Collinsville. Collinsville is 52 miles by rail from Bowen.

Description and Geology.—Lenses of ironstone occur over a length of 3 miles along the contact of limestone and granite. The limestone is altered to garnet-epidote rock and the ironstone is a contact-metamorphic type of deposit.

Size and Grade.—The largest lens of ironstone is reported to be nearly a quarter of a mile long and up to 200 ft. wide (Jensen, 1921). No estimate of reserves is given. A representative sample taken across three outcrops assayed 56·8 per cent. iron and 8·6 per cent. silica.

6. *Mount Wyatt.*

Location and Access.—The deposit is situated 44 miles south-west of Collinsville and 63 miles by road from the railhead at Collinsville.

Description and Geology.—The deposit consists of disseminated magnetite on the contact of Devonian sediments and granite. The magnetite is associated with garnet, epidote, and hornblende, and copper carbonate stains are also present. This is another contact-metasomatic type of deposit.

Size and Grade.—The largest outcropping body has a strike length of 400 ft. and a maximum width of 90 ft. Taking the most optimistic view, Connah (1953), estimated that the quantity of ore available above creek level would not exceed 150,000 tons. Nine samples averaged 38·0 per cent. iron and 29·1 per cent. silica.

7. *Woodstock.*

This deposit, situated south-west of Townsville, consists of very small high-grade lenses of maghemite of contact-metasomatic origin and reserves are quite insignificant.

8. *Mount Cardwell.*

The deposit is situated 7 miles by road from Ord siding on the Mount Garnet railway line and cupriferous ironstone flux was obtained from the mine for use at the Chillagoe smelters. It is a contact-metasomatic type of deposit and reserves of magnetite ore are quite small.

9. *Calcifer.*

Several very small deposits of cupriferous ironstone occur around Calcifer in the Chillagoe district. They are similar in type to other contact-metasomatic deposits described and do not warrant consideration as a possible source of iron ore.

10. *Mourilyan Harbour.*

An occurrence of hematite is located at Mourilyan Harbour near Innisfail, but Morton (1937) considered it of no possible economic significance.

D. Central Coastal Queensland.

1. *Iron Island.*

Location and Access.—This is an island in the Duke Group 48 miles north-east of St. Lawrence. It is roughly 200 miles by sea from Bowen.

Description and Geology.—The ironstone occurs as a number of separate bodies confined almost entirely to the southern half of the island. It consists of cryptocrystalline magnetite and massive hematite which replace Devonian limestone and slate.

Size and Grade.—The deposit was worked by Mount Morgan Gold Mining Co. Ltd. for ironstone flux, and between 1907 and 1921 390,179 tons of ore were shipped from the island. The grade of ore shipped in the later stages of production is indicated by the following assay:—Iron 67·25 per cent., silica 3·48 per cent., phosphorus 0·03 per cent. In the last half year of production 61·6 per cent. of the material mined was discarded as waste.

The deposit was surveyed and diamond drilled by the company. Six holes totalling 518 ft. were drilled to depths ranging from 50 ft. to 128 ft. Estimated reserves above high-water mark were placed at 132,000 tons and reserves to a depth of 50 ft. below high-water mark were placed at 500,000 tons. It is considered doubtful if the deposit could be safely worked below high-water mark.

2. *Mount Biggenden.*

Location and Access.—The deposit is situated 4½ miles west of Biggenden which is 54 miles by rail from Maryborough.

Description and Geology.—Magnetite occurs in association with native bismuth, bismuthinite, and gold and the deposit has been worked for its bismuth and gold content. Arsenides are also present in association with the other metals.

Size and Grade.—Dunstan (1917) classified the ore reserves as follows:—

	Tons.
Actual ore—	
(*a*) broken ore in dumps and open-cut	30,000
(*b*) exposed in open-cut and workings	110,000
Probable ore (beyond and between mine workings)	60,000
Possible ore (below and beyond mine workings)	300,000
Total	500,000

From 1942-1954, the Queensland Cement and Lime Co., Darra, have taken 18,329 tons of ironstone from mill tailings dumps. The utilisation of the magnetite for the production of iron and steel as a by-product of bismuth-gold production does not appear practicable. The fine grinding necessary to extract the bismuth and gold makes the iron ore unsuitable for a blast furnace feed without sintering. Four diamond drillholes were put down on the deposit in 1919 but the results were rather inconclusive.

The average grade may be represented by the following assay results:—Iron 57·7 per cent., silica 7·7 per cent., bismuth 0·05 per cent., phosphorus 0·04 per cent., and sulphur 0·13 per cent.

Similar deposits occur at Mount Havilah and Don Juan in the same area but ore reserves are not significant.

3. *Alma Creek.*

Location and Access.—The deposits are situated 15 miles south-south-east of the railway at Mount Morgan.

Geology.—The ironstone consists of finely granular titaniferous hematite and magnetite occurring in fissures within an area of gabbro. The deposits are probably magmatic segregations of the injection type.

Size and Grade.—(i.) Oakey Lode. Ball (1904) estimated reserves at 118,000 tons within 100 ft. of the surface. The deposit persists over a strike length of a mile and ranges in width from 2 ft. to 12 ft. There is a difference of 300 ft. between the highest and lowest point of outcrop. A representative sample assayed 56·27 per cent. iron and 10·40 per cent. silica.

(ii.) Pleasant Lode—This is over half a mile long and 6 ft. wide. Ball (1904) estimated reserves at 250,000 tons to a depth of 100 ft. A representative sample assayed 55·42 per cent. iron, 12·80 per cent. silica, and 0·114 per cent. phosphorus.

Saint-Smith (1919) states that the lodes are too narrow to allow economic exploitation by large-scale mining methods, and in addition the titania content of four samples ranged from 15·1 to 23·7 per cent. and is in excess of accepted limits.

4. *The Caves Area (Mount Etna).*

Location and Access.—The deposits occur 14 miles north-north-west of Rockhampton. The Caves railway station is 16 miles from Rockhampton.

Geology.—The ironstone occurs as small lenses of hematite and limonite replacing limestone. Garnet occurs in association with the ironstone along the contact of the limestone with a diorite intrusion.

Size and Grade.—There are several open-cuts and costeans and several thousand tons of ore are believed to have been mined for use as flux at Mount Morgan. The workings show the deposits to be small. Ridgway (1937) considered all the easily won ore had been removed. Three samples from the deposits averaged 64·5 per cent. iron and 6·4 per cent. silica.

5. *Mount Perry Area.*

Several deposits occur in the Mount Perry area which is 67 miles by rail from Bundaberg. The deposits are low grade and of no great size. At Perry Mountain ironstone which is a replacement of quartzite near granite has been quarried for flux. Probable reserves, assuming a depth of 15 ft., are estimated at 100,000 tons (Reid, 1919a) and samples of red ore and brown ore assayed 43·1 per cent. iron and 34·3 per cent. iron respectively. The Eastern Creek (Peter's Nob) lodes, 14 miles west of Wolca, are estimated to contain a maximum of 100,000 tons to a depth of 50 ft. An average sample assayed 37·7 per cent. iron.

6. *Glassford Creek.*

The deposit is situated 8 miles west-south-west of Many Peaks railway station which is 66 miles from Gladstone. The deposit was worked for copper and gold. Magnetite and garnet occur as the gangue minerals. The quantity of ore above the 200-ft. level is less than half a million tons (Ball, 1904) and it could only be worked in conjunction with copper-gold mining.

Minor Occurrences in Central Coastal Queensland.

Mount Fairview.—The ironstone is considered to result from the weathering of serpentine. Mount Fairview is situated 22 miles west of Yaamba which is on the North Coast line 23 miles from Rockhampton. Two samples assayed 61·6 per cent. iron and 29·8 per cent. iron.

Marlborough.—The deposit is located 7 miles south of Marlborough which is 60 miles north of Rockhampton on the North Coast line. It occurs near a serpentine contact and is probably a magmatic segregation deposit of the injection type.

Constitution Hill.—This is situated 3 miles north east of Mount Morgan. It is a high-grade replacement deposit but reserves are only 35,000 tons.

Iron Gully.—This is a similar high-grade replacement deposit occurring 6 miles west-south-west of Mount Morgan.

Razorback.—Ironstone occurs with low copper and gold values associated in this small deposit situated half a mile south of the old Moonmera railway station in the Mount Morgan district. A sample assayed 39·9 per cent. iron, 32·7 per cent. silica, 0·40 per cent. copper, and 1·95 dwt. gold.

Gayndah.—This consists of a lateritic hill capping composed largely of limonite and assaying 33·4 per cent. iron and 35·7 per cent. silica. Reid (1919b) considered reserves to be negligible.

Small high-grade contact-metasomatic deposits at Kabra, on the central railway, 11 miles south-west of Rockhampton; at Targinnie, 9 miles west of Gladstone; and at Mount Grim, 3½ miles west-south-west of St. Lawrence. At Many Peaks magnetite and hematite are associated with copper and iron sulphides. Ironstone from Kabra and Many Peaks was used as flux at Mount Morgan. A small deposit of magnetite occurs at Stanage which is situated on the coast 37 miles east of St. Lawrence. Other occurrences of ironstone are located in the Boyne River area and at Kroombit, Cania, Degalgil and Cabbage Tree in the Gladstone district.

E. Southern Coastal District.

Several occurrences are known in the southern district but all are too low-grade or too small to warrant consideration as a source of iron ore.

At Pine Mountain, 5 miles north-north-west of Ipswich ferruginous quartzite occurs in association with a serpentine belt. Samples assayed from 31·1 per cent. iron to 23·2 per cent. iron and carried up to 5 per cent. chromic oxide. Other occurrences are reported 12 miles from Fernvale on the Esk road; 3 to 4 miles north of Ipswich, in the parish of Dundas; 18 miles from Bellvue railway station on the Esk line; and in the parish of Dungandan, 2½ miles east-north-east of Boonah.

On the Darling Downs lateritic deposits on basalt and clay ironstones are reported from the Pittsworth, Warwick and Texas areas. At Elbow Valley, 16 miles from Warwick, ironstone assaying from 52·0 per cent. iron to 60·3 per cent. iron occurs, but trenching showed that the deposit is superficial (Saint-Smith, 1919).

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(A. K. Denmead, M.Sc., Chief Government Geologist)

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 7. WESTFALEN No. 2 MINE AREA, DINMORE

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.

PART 7. WESTFALEN No. 2 MINE AREA, DINMORE.

SUMMARY.

Diamond drilling of the Westfalen No. 2 mine area, initiated to provide information for use in planning a new haulage installation, was extended at the request of the proprietors to delimit available reserves.

The attached report by Mr. H. R. E. Staines, Geologist, sets out the results of the work.

Thirteen bores, varying in depth from 185 ft. to 619¼ ft. and agggregating 5,380½ ft., were drilled to intersect three highly banded seams which occupy a stratigraphic position near the top of the Tivoli "Stage" and the base of the Cooneana "Stage" within the Ipswich Coal Measures. Correlation with the succession at Haighmoor (North Ipswich), though generally recognisable, is not entirely satisfactory due to marked deterioration of the seams westerly.

The seams do not outcrop, the coal measures being overlain extensively by up to 200 ft. of Tertiary sediments and alluvium. Pre-Tertiary denudation has removed portion of the Top Seam in the eastern part of the area.

The area is exceptional in that mine development has proceeded in selected sections of two relatively thick, shale-banded seams and washing with heavy discard is practised to produce coal of marketable quality. Calculation of reserves has therefore necessarily been based on criteria suited to the special conditions obtaining.

No allowance has been made in calculation for loss in mining due to faulting nor has account been taken of the present prohibition on the working of coal within 200 ft. of the surface in the Dinmore town area, which would exclude a considerable tonnage of Top Seam coal lying just above this limit.

"Measured" reserves in the Top Seam, considered of immediate value because of its thickness, have been calculated on an average thickness of 15 ft. 3½ in. over an area of 87 acres as 2,590,000 tons. Marketable coal amounting to 1,530,000 tons could be produced by discarding 41 per cent. in washing to reduce ash content from 44·1 per cent. to about 24 per cent.

It is considered that the Middle Seam, though at present unworkable, will prove of future economic value. Accordingly, "measured" reserves have been calculated on an average workable thickness of 7 ft. 3¼ in. over an area of 143 acres as 2,680,000 tons. Marketable coal amounting to 1,690,000 tons could be produced by discarding 37 per cent. by washing to reduce ash content from 45·1 per cent. to approximately 24 per cent. "Indicated" reserves, calculated on the basis of 6 ft. 5 in. average thickness over an area of 109·2 acres, amount to 1,400,000 tons, with ash content of 43 per cent.

The Bottom Seam, because of variable thickness and a generally high proportion of stone, is regarded as unworkable.

It is probable that the Top and Middle Seams will contain additional reserves in the area adjoining that tested on the south.

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.

PART 7. WESTFALEN No. 2 MINE AREA, DINMORE.

I. Introduction.

Westfalen No. 2 Colliery is located in portions 32 and 33, parish of Goodna, on C.M.L. 389. Access to the workings is gained by a cross-measure drift from a point on the surface approximately 21·5 chains north of the south-eastern corner of portion 33.

The two seams worked in the colliery contain numerous shale bands, the presence of which necessitates washing of the coal prior to marketing. Production comes at present from only one seam, the Top Seam, and amounts to about 210 tons of cleaned coal daily.

The drilling campaign conducted by the Mines Department established the extension of these seams over a considerable area, and the present report sets out the information gained and the conclusions reached as a result of that campaign.

The report is accompanied by the following plans and sections:—

1. A plan showing borehole locations, topography, surface geology, underground workings, approximate reserves areas, survey grid and locality plan. (Figure 1.)

2. Four geological cross sections. (Figure 2.)

3. Generalised bore sections. (Figure 3.)

4. Detailed sections of the workable seams in the boreholes, showing core recoveries, sampled lengths and analyses. (Figures 4, 5, 6, 7, 8.)

5. Detailed sections of the seams in Westfalen No. 2 Colliery, showing the analyses of samples taken. (Figure 9.)

6. A skeleton plan showing an interpretation of the contours of the base of the Tertiary deposit. (Figure 10.)

II. Diamond Drilling.

The drilling campaign was initiated to give information on the grade of a proposed new underground diesel locomotive haulage road, but was extended at the request of the colliery proprietors to delimit the anticipated reserves. Drilling commenced in July, 1954, and continued until January, 1955. A total footage of 5,380 ft. 7 in. was drilled, spread over thirteen holes numbered respectively N.S.94, 95, 97, 98, 100, 101, 102, 103, 105, 106, 107, 109 and 111.

The deepest of these was N.S.94, which penetrated the strata to a depth of approximately 423 ft. below the lower working seam and reached a depth of 619 ft. 3 in. (Figure 3). The shallowest hole was N.S.97, 185 ft. deep, a redrill of N.S.95.

Core recovery was generally very good, in spite of the fragmentary nature of the coal, and in many cases 100 per cent. recovery was obtained in the coal seams. Of the 5,380 ft. 7 in. drilled, 4,520 ft. 7 in. were cored, and 4,375 ft. 3¼ in. of core were recovered, representing a recovery of 96·8 per cent. In the coal seams, 404 ft. 7½ in. of core were recovered from 415 ft. 6½ in. of drilling, equal to a recovery of 97·4 per cent.

III. Summary of Geology.

The lowest beds exposed in the area are the sandstones and shales of the Ipswich Coal Measures of Middle to Upper Triassic age. They contain the seams which are worked at the Westfalen No. 2 mine. Their regional strike is ENE–WSW and they dip to the SSE at angles varying locally between 3 deg. and 20 deg., averaging 8 deg.

Flat-lying Tertiary sediments consisting mainly of shales with thin sandstone beds have been deposited on the eroded surface of the coal measures.

The most recent deposits are the beds of river alluvium flanking the Bremer and Brisbane Rivers.

In the present report, these several units will be considered in descending order.

IV. Alluvium.

The Bremer River flows in a general easterly direction about half a mile north of the Westfalen mine. Its associated alluvium is spread over both right and left banks of the river, up to a width on either bank of about 30 chains. The alluvium is at a minimum in the north-west of the area under consideration. Here, the outer bank of each of two sharp bends in the course of the river has been entrenched to produce cliffs and steep banks in a thick bed of sandstone. The watercourses tributary to the Bremer River are also occupied by a thin deposit of alluvial material. The wide lateral extent of the alluvium prevents a complete surface inspection of the Ipswich Coal Measures by obscuring outcrops in areas where a knowledge of the coal measures would greatly assist in the geological interpretation.

V. Tertiary.

The exposure of the Ipswich Coal Measures to the north of the railway line at Dinmore is limited also by a fairly extensive cover of shales, clays and soft argillaceous sandstones of Tertiary age. These sediments occupy the greater part of the area between the river and the railway line (Figure 1). They are the north-eastern section of a much larger Tertiary deposit stretching some seven miles to the south-west.

All of the holes drilled in the Westfalen area passed through these Tertiary beds. The thickness ranged from 30 ft. in N.S.102 and N.S.106 to 180 ft. in N.S.98 (Figure 3). The greatest depth is in the eastern part of the area, on the boundary between portions 31 and 32, where the base of the Tertiary is some 200 ft. from the surface. Bore N.S.107 passed through a thickness of more than 100 ft. of Tertiary beds; but in Ashburn Road, only 8 chains south-east of this bore, Triassic sandstone is seen to outcrop. Similar changes in the thickness of the sediments occur between adjacent bores. As the area is one of low relief, these differences are evidence of an irregular pre-Tertiary basement (Figure 10).

The sequence occurs at or near the base of the "Redbank Plains Series" as defined by A. K. Denmead (1955A, p. 4), and is regarded as belonging to the Eocene or Oligocene period.

The sediments are chiefly soft clayey shales and fine-grained sandstones. The shales are generally light-coloured, but vary from almost white to light grey, yellow and reddish-brown, with one occurrence in bore N.S.107 of banded greenish shales. The sandstones are thinly-bedded and quite argillaceous.

Elsewhere on the Ipswich field departmental boring disclosed the presence, of academic interest only, of sandstone aquifers in the Tertiary deposits. No such beds were recognised in the Dinmore area. In Ashburn Road between portions 33 and 140 there occur numerous boulders which apparently form a bed in the Tertiary sequence, although this was not met with in any of the boring. The boulders consist largely of yellowish-brown, red and white opaline and chalcedonic silica and quartzite; with minor amounts of petrified wood.

The members of this Tertiary sequence have some economic value in that the shales are quarried for use in the manufacture of pottery and earthenware.

VI. Ipswich Coal Measures.

The typical shales, siltstones and sandstones of the Ipswich Coal Measures were met with in all the bores. Surface exposures are few, owing largely, as mentioned above, to the extensive cover of Tertiary and alluvial deposits. The drilling proved the existence of three seams within the area, of which the upper two have been worked at the mine and the lowermost is too thin to be workable. In the area to the east of the mine a large part of the Top Seam has been removed by pre-Tertiary erosion. No outcrop of any of the three seams is known; but coal has been discovered in several prospecting openings.

The Ipswich Coal Measures have been divided by A. K. Denmead (1955A) into four stratigraphic units, namely, in ascending order, the "Kholo Stage," the "Tivoli Stage," the "Cooneana Stage" and the "Blackstone Stage." Practically all the productive beds on the Ipswich coalfield lie within the Tivoli and Blackstone "Stages." The Westfalen seams occur at the junction of the Cooneana and Tivoli "Stages," between which the demarcation line has been arbitrarily defined as the bottom of "the sandstone overlying the Garden Seam." What is possibly the horizon of that seam occurs between the Top and Middle Seams at Westfalen.

To the west of this area lies the Haighmoor mine area, which was previously drilled by the Mines Department. No completely satisfactory correlation of the seams in the two areas can be obtained. The only persistent feature common to the two areas is a dolerite sill with which are generally associated thin bands of coked coal and baked carbonaceous shale. In reporting the results of the Haighmoor drilling, A. K. Denmead (1955B) assumed that the sill occupied the horizon of the Garden Seam which it had destroyed.

In the Westfalen area the sill lies between the Top and Middle Seams. The interval from the floor of the sill to the roof of the Middle Seam diminishes from west to east (Figure 2, Section DD′) ranging from 57 ft. in N.S.103 and 43 ft. in N.S.102, to 10 ft. in N.S.94 and 2 ft. in N.S. 95. In the Haighmoor area, the sill lies from 142 ft. to 229 ft. above the Haighmoor Top Seam.

A comparison of the sequence in holes N.S.103 (Westfalen) and N.S.50 (Haighmoor) discloses a broad similarity between the stratigraphic columns in the two areas. The sandstones containing coarse and pebbly bands and some interbedded siltstones and shales in the bottom 140 ft. of N.S.103 correspond to a similar sequence in the bottom section of N.S.50. It is these massive sandstones that outcrop in the north-western part of the area mapped (Figure 1) and form conspicuous bluffs along both banks of this stretch of the Bremer River. In the upper part of each hole there are interbedded shales and siltstones with several coaly sections.

The Westfalen Top Seam is absent from the Haighmoor sequence. The Middle Seam is represented only by a thin carbonaceous band at 324 ft. in N.S.50 and at 355 ft. in N.S.51. The Bottom Seam, which diminishes to a thickness of three feet in N.S.103, can probably be equated with a thin band of carbonaceous shale at 482 ft. in N.S. 50. Similarly, a thin coaly band at 408 ft. in N.S.50 which has been tentatively described as the Haighmoor Top Seam reappears in N.S.103 halfway between the Westfalen Middle and Bottom Seams.

(*a*) *Westfalen Top Seam.*—The Westfalen Top Seam was intercepted in all the bores except N.S.98. In that hole it had been removed by erosion prior to the Tertiary deposition. In holes N.S.95, 97 and 105 the greater part of the seam had likewise been destroyed. To the east of the colliery the seam was of workable quality in holes N.S.94, 100, 101, 106, 107 and 109. In N.S.111, it had deteriorated to

such an extent as to be quite unworkable. To the west of the colliery, in holes N.S.102 and N.S.103, the seam had split into two sections and had further seriously deteriorated in quality. Normally the seam contains a large number of shale bands varying in thickness up to 4 inches (Figures 4 and 5). The thickness of the coal plies is therefore not great, and does not exceed 18 inches.

The full section of the seam shows a maximum thickness of 22 ft. 5 in. in N.S.100 and a minimum thickness of 14 ft. 10 in. in N.S.106. The average, exclusive of the split sections in N.S.102 and N.S.103, is 20 ft. The section being worked in Westfalen No. 2 Colliery (Figure 9) comprises a thickness of about 10 ft. 6 in. lying from 2 ft. to 2 ft. 6 in. below the top of the seam.

The workable section in the bores averages 15 ft. 3½ in., ranging from 11 ft. 8 in. in N.S.109 to 19 ft. 6 in. in N.S.94. The average ash content for that section is 44·1 per cent., ranging from 41·2 per cent. in N.S.94 to 46·8 per cent. in N.S.107. In some holes, notably N.S.106 and N.S.107, there is a stony middle section from 1 ft. to 2½ ft. thick which would be discarded underground during mining operations. By discarding this section and washing the remainder at specific gravity 1·8, the ash could be reduced to about 24 per cent., with a total discard of about 41 per cent.

(*b*) *Westfalen Middle Seam.*—The Westfalen Middle Seam was penetrated in all the holes drilled, being unaffected by the Tertiary denudation. Its distance below the Top Seam averages 106 ft., and the interval is occupied mainly by sandstones, with subordinate thicknesses of shale and siltstone (Figure 3). Because it is less than half the thickness of the Top Seam and is of slightly lower quality, it is a less attractive mining proposition.

In the drilling, the quality of the seam showed considerable variation, but generally was poorest along the eastern boundary of the area drilled. Only in N.S.105 did the seam fail to show any workable section; but in holes N.S.107, 106 and 111 the lower limits of workability were almost reached.

The average thickness of the full section is 10 ft. 8½ in., the maximum being 15 ft. 8 in. in N.S.106 and the minimum 6 ft. 9 in. in N.S.102 (Figures 6, 7 and 8). The section which has been worked in the mine (Figure 9) lies towards the bottom of the seam and is approximately 7 ft. 3 in. thick. Face samples taken underground by the writer had an ash content of up to 42 per cent. In the bores, the workable sections average 7 ft. and have an average ash content of 45·8 per cent.

Shale bands in the seam average slightly over 1 inch in thickness with a maximum of 6 in. Their distribution divides the working section into three nearly equal divisions. The greater proportion of bands is in the middle division, where also the coal is inferior. In mining operations, much of this dirty section can be discarded at the face.

To the west of the mine workings, in N.S.102, the seam deteriorates to a 4 ft. 6¾ in. workable section containing 39·8 per cent. ash; but it improves in N.S.103 to a workable section of 7 ft. 2½ in. containing 42·8 per cent. ash.

Washability tests carried out on core samples at specific gravity 1·8 indicate that the average ash content of 45·8 per cent. could be reduced to 24 per cent. by discarding about 37 per cent. of the coal extracted. Any increase in the amount of the dirty middle section which is discarded underground would require an increase in the overall discard.

In holes N.S.95, 98, 100, 101 and 105, the dolerite sill occurs sufficiently close to the seam to have partially coked the top 5 to 6 ft.

At the top of the seam section in N.S.109, there was a 2 ft. 5½ in. band of finely fibrous coal with a silky lustre resembling fusain. What appeared to be parallel fibres were seen under the lens to be tiny elongated vesicles in a vitreous coaly material. This effect is apparently due to coking brought about by the nearby sill. Faulting has removed the topmost section of the seam and the sill also.

The Middle Seam in N.S.107 is partly coked in its lower parts, but this has been effected by a nearby dyke which is probably genetically related to the sill.

(*c*) *Westfalen Bottom Seam.*—This seam lies at an average distance of 95 ft. below the Middle Seam. The intervening strata are comprised of varying thicknesses of shales and coarse sandstones (Figure 3). The full seam section varies widely in thickness from a minimum of 2 ft. 5 in. in N.S.107 to a maximum of 17 ft. 3½ in. in N.S.100; the average of all intercepts is 8 ft. 1 in. The coal plies in this section are generally cleaner and of better quality than either of the upper two seams. One such ply in N.S.100, 2 ft. 8 in. thick, contained 29·5 per cent. ash and a 5 ft. 1 in. section in N.S. 101 contained 38·7 per cent. ash. However, these bands do not often exceed 2 ft. in thickness and are subordinate in thickness and number to the interbedded shale bands. This renders the seam quite unsuitable for working.

VII. Igneous Activity.

Igneous activity in the area is confined to the dolerite sill mentioned above and a dolerite dyke in hole N.S.107. Elsewhere on the Ipswich coalfield, there are basalt flows interbedded with the Tertiary sediments. These occur higher in the sequence than the beds at Dinmore, and are consequently not represented here.

The dolerite sill has been intruded into the strata between the Top and Middle Seams (Figure 2). It was penetrated in every hole except N.S.106, 107, 109 and 111, its thickness ranging up to 9 ft. 6 in. in N.S.102 and averaging about 6 ft. It is furthest above the Middle Seam in the west of the area, where the maximum interval is 57 ft. In the east it approaches to within 2 ft. of the seam and has partially coked the upper 5 to 6 ft. (Figure 2, section DD′). The interval in the mine tunnel is 24 ft.

In the fresh unweathered state it is dark grey to black, with a greenish tinge due to the presence of chlorite as an alteration product. Frequently it has been affected by weathering processes and is much lighter in colour and softer. No surface exposure of the sill has been discovered.

It is apparently the same sill as that encountered in the Haighmoor drilling. In that area it was tentatively assigned to the horizon of the Garden Seam; the associated baked carbonaceous shale and coked coal were assumed to be the unreplaced remnants of that seam. A similar association of sill and coked coal exists in this area, but no evidence is available to corroborate the correlation with the Garden Seam.

The dolerite dyke occurs only in hole N.S.107 and is not known to outcrop. Since it was intercepted at five different places in the hole it is assumed that, though generally vertical, it has an irregular margin. It is a light grey fine-grained rock, becoming dark greenish-grey and felsitic near the contact with the sediments. It is often amygdaloidal, especially near the margins. In one section of several feet it contains large idiomorphic felspar phenocrysts up to 1½ inches in length.

The effects of the intrusion of the dyke are similar to those produced by the sill, namely, coking of the coal and induration and darkening of the shales. The lower section of the Middle Seam in N.S.107 has been partially coked by the dyke (Figure 8). While there is insufficient evidence to prove the connection, the similarity between the sill and the dyke suggests that they are genetically related. The dyke is intrusive into the Tertiary sediments at the top of N.S.107, and it is therefore likely that it is associated with the later Tertiary volcanic activity which extruded the basalts in the upper section of the Tertiary sequence.

VIII. Faulting.

The Westfalen mine area is considerably disturbed by faulting. There are several normal faults intersecting the mine workings, trending approximately NNW-SSE (Figure 1). They have generally steep angles of dip and displacements from a few feet to about 30 ft. (Figure 2, Section DD′). The downthrow is usually to the west. One fault with a throw of about 30 ft. forms the western boundary to the workings in the Top Seam and interrupts the Middle Seam workings. Within 4 chains of the main displacement there are several minor displacements striking in the same direction. At the western end of the Middle Seam workings, minor faulting and a slight change in the attitude of the seam suggest the proximity of another fault. A disparity between the levels in the workings here and the depth of the seam in the nearby hole N.S.102 indicates a fault of approximately 20 ft. Faulting exists also on the east of the Middle Seam workings, striking in the same direction.

The disturbance of this area by faulting is responsible for the changes in strike of the seams between different parts of the mine. In the western half of the Middle Seam workings, the strike is east-west, which approximates to the general regional strike of ENE-WSW. East of the 30 ft. fault mentioned above, the average strike is slightly east of north; and the normal regional strike is seen only in the eastern extremity of the Top Seam workings. The blocks between the faults have been tilted to varying degrees and the consequent alteration in strike is accentuated by the low angle of dip of the strata.

The same effect has been produced in the area tested by the bores. Discrepancies exist between the levels of the seams in several adjacent bores. If it is assumed that all the strata dip uniformly in the same direction at the angles observed in the core, the complex network of faults required to explain these discrepancies would be hardly feasible. It is considered that noteworthy faulting occurs only in certain places, mainly immediately to the east and south-east of the workings (Figure 2, Sections CC′ and DD′). The remaining anomalies would then be accounted for by the changing direction of dip.

The faulting in this locality is related to the Ebbw Vale Fault, a major feature occurring about a mile to the south-east of the mine, and striking NW-SE. There, the displacement is of the order of 450 ft., with the downthrow to the west. A. K. Denmead (1955A, p. 96) considers that the Ebbw Vale Fault peters out between Ebbw Vale Colliery and the Bremer River. Since the several faults at Westfalen lie on the projection of the fault and the overall downthrow is also to the west, it is almost certain that they represent the petering-out of that major feature.

The influence of this fault is also seen along the same structural line in a clay quarry in portion 139, where the Triassic shales dip at moderate angles to the south-west (Figure 1).

IX. Description of Coal.

There is virtually no difference between the respective physical and chemical properties of the Top and Middle Seams. The coal is high-volatile bituminous in rank and bears a strong resemblance to the Tivoli "Stage" coals of North Ipswich. It is bright and friable, with a sub-cubical fracture.

As mined, the coal has a very high ash content, in the vicinity of 40 per cent. This is reduced by washing processes to about 25 per cent. Coal containing 40 per cent. ash would have a calorific value of about 8,000 B.T.U. per lb. and coal of 25 per cent. ash slightly less than 11,000 B.T.U. per lb.

The unwashed coal is unsuitable for coke-making, owing to the high ash content. Samples C and D (Middle Seam) are classified as "firmly agglomerating" and both have a swelling index of 1½. Reduction of the ash content by washing improves the coking properties. The washed fractions (specific gravity less than 1·8) of samples A and B (Top Seam) are classified as "medium coking" and of sample E (Middle Seam) as "strongly coking". Their swelling indices are 5½, 4, and 5 respectively.

Top Seam.—The Fixed Carbon values (dry mineral-matter-free basis) vary between 63·6 per cent. and 66·8 per cent. (average 65·3 per cent.). Moisture ranges from 1·5 per cent. to 2·6 per cent. (average 2·1 per cent.). Sulphur has a range of 0·30 per cent. to 0·48 per cent. (average 0·38 per cent.). These figures are based on the analyses of eleven samples.

Middle Seam.—The Fixed Carbon values (dry mineral-matter-free basis) average 65·4 per cent. in a range of 62·8 per cent. to 67·5 per cent. Three abnormal figures of 57·0 per cent., 70·2 per cent. and 70·4 per cent. were disregarded in the calculations. Moisture varies from 1·1 per cent. to 2·6 per cent. (average 2·1 per cent.). Sulphur has a range of 0·25 per cent. to 0·44 per cent. (average 0·37 per cent.). The foregoing figures are based on the analyses of fifteen samples.

X. Coal Reserves.

Reserves exist in the Westfalen No. 2 mine area in the Top and Middle Seams only. They have been calculated on a different basis from reserves previously quoted for other mine areas in the Ipswich district. The maximum allowable ash content for reserves, formerly taken as 30 per cent., was increased to 35 per cent. for the Haighmoor reserves, but in the case of Westfalen needs to be increased still further to about 45 per cent. This is in view of the fact that face samples taken in the mine showed that the working sections of the seams contain 38 per cent. to 42 per cent. ash. Washability tests on the samples at specific gravity 1·8 gave a product containing about 22 per cent. ash with an average 33 per cent. discard.

On discussing the method of estimating reserves with the Fuel Technologist of the Queensland Coal Board, it was agreed that under present-day conditions, the Top Seam would be just workable, mainly because of its thickness, but that the Middle Seam would become workable only when the average grade of coal available for mining in the West Moreton district had deteriorated. It was therefore recommended that reserves should be calculated under the following headings:—

1. Reserves of immediate value, i.e. *Top Seam*:—
   (*a*) "measured"—area defined by bores and mine workings and 5 chains beyond; less area washed out.
   (*b*) "indicated"—area between this and the outcrop under minimum cover of 50 ft.
2. Reserves of future value, i.e. *Middle Seam*:—
   (*a*) "measured"—as above.
   (*b*) "indicated"—as above.

The samples taken from the core for analysis do not necessarily correspond exactly with the sections of the seams worked in the mine. The coal plies vary in thickness and quality and the shale bands likewise are not constant. Therefore the section sampled in each hole was that considered to be workable at that particular point. The figures quoted below are based on the weighted averages of the analyses of these sections.

The calculated reserves represent the total quantity of workable coal. Some of this coal will be unavailable by reason of the disturbance of the seams by faulting, but it is impossible to estimate the quantity that will be thus lost. Enforcement of a prohibition on the working of coal shallower than 200 ft. in the Dinmore town area would also exclude a considerable tonnage of Top Seam coal which lies just above this limit. Such contingencies have not been allowed for in the calculations.

1. *Top Seam* (*a*) "Measured" reserves exist over an area of 87 acres lying mainly to the south-east of the mine (Figure 1). The average thickness of workable coal is 15 ft. 3½ in. of which the weighted average ash content is 44·1 per cent. Using a specific gravity of 1·670 estimated on the basis of the average ash content, this represents a tonnage of 2,590,000. Mine samples were excluded from these calculations because the section worked in the mine is smaller and probably of slightly better quality than the full workable section. (*b*) No "indicated" reserves as above defined exist in the Top Seam.

2. *Middle Seam* (*a*) "Measured" reserves extending mainly to the east and south-east of the present mine workings cover an area of 143 acres (Figure 1). The average thickness of workable coal is 7 ft. 3¼ in., of which the weighted average ash content is 45·1 per cent. Using an estimated specific gravity of 1·727, this represents a tonnage of 2,680,000. These figures are based on both mine and bore samples.

(*b*) "Indicated" reserves are based on holes N.S.102 and 103 and mine samples. Lying mainly to the west of the mine, but also including a narrow strip between "measured" reserves and the outcrop,

they occupy a total area of 109·2 acres (Figure 1). It is estimated that their average thickness would be about 6 ft. 5 in. and average ash content about 43 per cent. With specific gravity estimated at 1·702, the tonnage amounts to 1,400,000.

In portions 139 and 140, immediately south of Ashburn Road, both Top and Middle Seams are very probably continuous with the sections observed in the mine and the bores. However, as this area was not embraced by the Westfalen company's lease, no drilling was undertaken there and no reserves can be estimated. Subject to the satisfactory completion of negotiations by the proprietors to acquire this property, further diamond drilling would be warranted to determine the extent of the Westfalen seams here.

XI. Conclusion.

The diamond drilling has proved the continuation of the two seams that have been worked in Westfalen No. 2 Colliery over a considerable area adjacent to the mine. Their stratigraphic position is near the junction of the Tivoli and Cooneana "Stages" of the Ipswich Coal Measures, but they have no correlatives amongst the seams known elsewhere on the field.

In the Top Seam, development will be limited to the east by a Tertiary washout and to the west by serious deterioration of the seam. "Measured" reserves totalling 2,590,000 tons and containing 44·1 per cent. ash have been calculated. Marketable coal amounting to 1,530,000 tons and containing about 24 per cent. ash could be produced by discarding about 41 per cent. in a coal washing plant operating at specific gravity 1·8.

The Middle Seam cannot be worked economically at present because of its lesser thickness and reserves have been calculated on their expected future value. "Measured" reserves, lying to the east and south-east of the mine, amount to 2,680,000 tons and contain 45.1 per cent. ash. Marketable coal amounting to 1,690,000 tons and containing about 24 per cent. ash could be produced from this seam by discarding about 37 per cent. To the west, the seam has not been sufficiently tested to class reserves as "measured" so that "indicated" reserves are estimated at 1,400,000 tons, carrying 43 per cent. ash.

In an adjacent untested area south of the mine workings, further reserves probably exist in both seams.

XII. References.

DENMEAD, A. K., 1955A. "The West Moreton (Ipswich) Coalfield," Geol. Surv. Q'land. Publication No. 279.

DENMEAD, A. K., 1955B. "Coal Resources, West Moreton (Ipswich) Coalfield, Part 3. P.D.T.S. No. 17 Mine Area, Haighmoor," Geol. Surv. Q'land. Publication No. 282.

By Authority: A. H. TUCKER, Government Printer, Brisbane.

FIG. 1

LEGEND

Ipswich Coal Measures	Geological boundaries
Tertiary sediments	Established, pos° accurate
Alluvium	Established, pos° approx.
Faults	Established, concealed
Established, pos° accurate	Inferred, probable or indef
Established, pos° approx	Inferred, prob or indef, concealed
Established, concealed	Boundaries of calculated reserves
Established in mine wkgs	Top seam, measured
Inferred, probable or indef	Middle seam, measured
Inferred, prob or indef, concealed	Middle seam, indicated
Coal seam at surface	
Strike & dip of strata	
Colliery Adit	
Shaft	
Diamond drillhole	N.S. 94
Surface contours	
Section line	A — A'
Sample taken in mine wkgs	× B
Workings on Top Seam	
Workings on Middle Seam	

DEPARTMENT OF MINES · QUEENSLAND ·

PLAN OF WESTFALEN No 2 MINE AREA DINMORE

IPSWICH COALFIELD

Parish of Goodna · County of Stanley · Warden's District of Ipswich

SHOWING SURVEY GRID, TOPOGRAPHY, SURFACE GEOLOGY, BOREHOLES, MINE WORKINGS & RESERVES

To accompany report by H.R.E. Staines, B.Sc., Geologist, Feb. 1956

Surveyed by Ewan Cowley, Surveyor, Jan. 1955

SCALE OF CHAINS

10 0 10 20 30

JAW 9456

SURVEY DATA

Meridian of Grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of Sub I Por 213, Parish of Ipswich

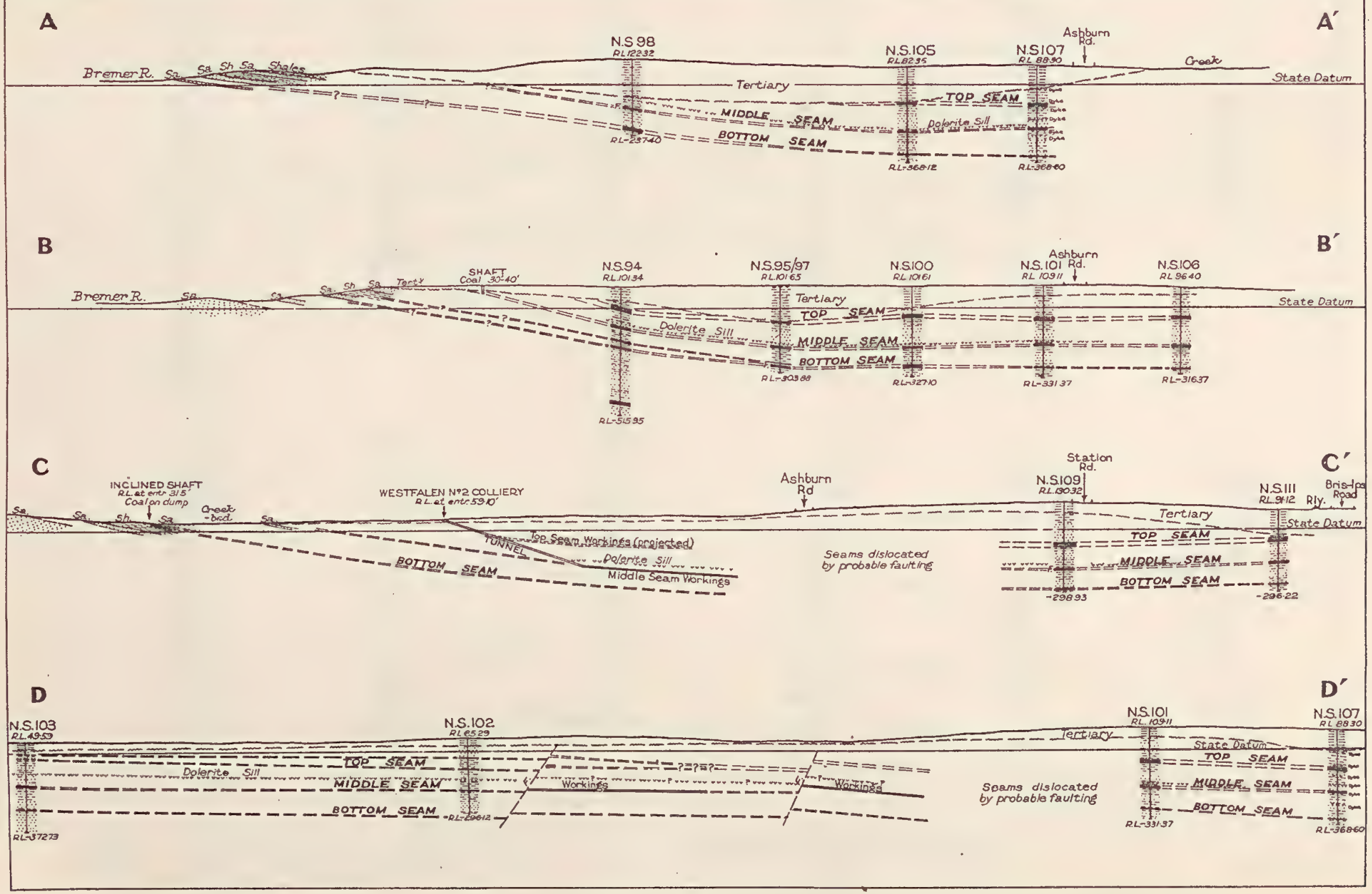
Elevations in feet on State Datum

WESTFALEN Nº2 MINE AREA, DINMORE · CROSS SECTIONS ·

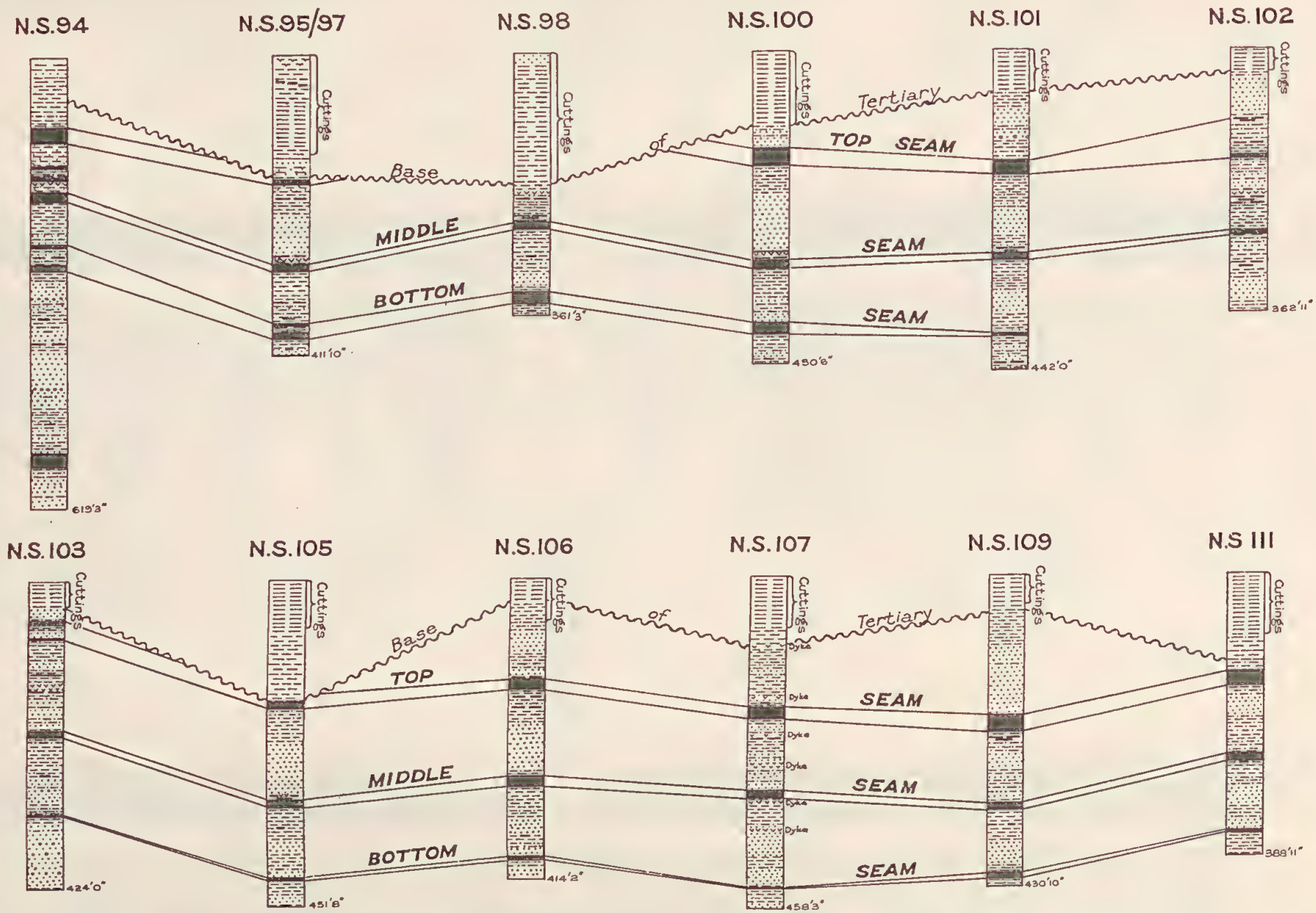
SCALE—HORIZONTAL & VERTICAL
CHAINS 4 3 2 1 0 4 8 12
800 600 400 200 0 100 200 FEET

FIG. 2

To accompany report by H.R.E. Staines, B.Sc, Geologist.



WESTFALEN Nº2 MINE AREA, DINMORE • GENERALISED BORE SECTIONS



· LEGEND ·

coal
coal & shale bands
coaly shale
shale
siltstone
sandstone
dolerite
conglomerate
clay
ironstone

SCALE OF FEET
100 0 100 200 300 400

To accompany report by H.R.E.Staines, B.Sc., Geologist.

FIG. 3

SEAM SECTIONS
WESTFALEN Nº 2 —— TOP SEAM

FIG. 4

Proximate Analysis, Washability etc.	Recovery per cent	Section Sampled	N.S.94	Description
			91'4"	
				1'10½"(bkn) iron-stained clay with 1" l.gy.sh at top;
			85'2"	1½"(p.broken) inf. coal,
				4¾"(broken) coal,
				1" bluey, ½"(bd.fn.sh & coal bds.) 1" coal, ½" carb.sh.,
				1¾" coal, ½" fawn sh., 1¾" coal,
			84'8¾"	¾" bluey, 1" coal, ½" fn.sh.,
				1'0¾"(part.bkn.) coal w bluey bds.,
				2" l-m.gy.sh. w. coal lents. in top ¾";
				2½"(broken) coal,
				1½" l.gy.sh., 3⅛"(part.bkn.) coal,
				⅛" l.gy.sh., 2½" bluey,
				10¾"(broken) coal 50%, bluey 50%,
				1½" l.gy.sh., 3"(bkn) coal & bluey, ¾" l.gy.sh.,
				2½"(bkn) coal,
				1" inf. coal, ⅜" l.gy.sh.,
				5⅜"(p.bkn) coal & bluey bands 1" wide,
				4" l.gy.sh.,
				1" carb.sh., ½" l.gy.sh.,
				10⅜"(part.bkn) coal & inf. coal,
				⅜" m.gy.sh., ⅛" carb.sh., ½" inf. coal,
				1½" wh.sh., ⅛" interbd l.gy. & carb.sh., 2⅝"(p.bkn) coal,
				⅜" carb.sh., ¼" coal, 1¾"(p.b.) carb.sh. grad. to bluey (⅛"),
				½" l.gy.sh., 4"(p.bkn) coal,
				3"(partly bkn.) bluey,
				1" carb.sh., 1" l.gy.sh.,
				5⅛" coal w carb.sh. bds.,
				2¼" m.gy.sh. w irreg bds., l.gy.sh., 1" carb.sh.,
				3½"(partly bkn.) coal,
				¼" carb.sh., 1½" wh.sh., 4" very inf. coal w. carb.sh.
				bds. ⅛" wide, 2"(bkn.) fawn sh., ⅛" carb.sh.,
				⅜" inf. coal, 2¼" carb.sh., ¼" m.gy.sh.,
				¼"(bkn) carb.sh., 1¼"(bkn) coal, ¾" bluey, ½" fawn sh.,
				4½"(bkn) coal & inf. coal,
				4" d.gy.sh., ¼" fn.sh., 1" carb.sh.,
				1'1¼"(bkn) coal, inf. in top 2" & w. few ⅜" carb sh bds.,
			108'4¾"	(p.bkn) carb.sh. w coal lents., ⅜" fawn sh.,
				¼" carb. sh., 2"(bkn) coal, ⅜" fawn sh., ¼" thinly
				interbd. fawn sh., carb.sh., & coal, 2"(bkn) coal,
				¼" carb.sh., 1½" fawn sh. w. carb lents., gr. to fn.shar.,
				2"(bkn) bluey, 5½"(bkn) coal with ⅛" bluey 3½" from
				top, 2¼" carb.sh.,
				2½" d.gy.sh. w carb.sh. lam., 2½"(bkn) coal w. few
				thin bluey bds., ½"(bkn) coal, 2" m.gy.sh.,
				3¼" l.gy.sh., 1¼" coal w num carb.sh. lam., 1" coal,
				½" m.gy.sh., ½" coal, 1" bd. m.gy.sh. & carb.sh., ½"(bkn) coal,
				¾" coal, ¼" carb.sh., ½" coal,
				7½"(p.b.) coal w thin bds. carb. & d.gy.sh. fr. 23½" fr. top,
			112'9"	1"(p.bkn) carb.sh., 1" d.gy.sh.,
				4" l.gy.sh., ¼" l-m.gy.sh.,
				4"(bkn.) bluey;
				10½"(broken) coal & inf. coal,
				¼" carb sh., 1½" m.gy.sh.,
				9½"(partly bkn.) coal,
				¾" bluey, 1¼" l.gy.sh., ½" l.-med. gy.sh.,
				5½"(p.bkn) coal & inf. coal w. few ⅜" bands bluey,
			115'5½"	(bkn) coal 70%, bluey 20%, carb.sh 10%, 1¼" carb.
				sh w coal lents., 1" m.gy.sh. w. coal lents., 1½" inf. coal,
				½" m.gy.sh., 2½"(bkn) coal & inf. coal,
				⅜" carb.sh., 1¼" coal & inf. coal, 1¼" carb.sh.,
				1½"(p.bkn) coal,
				⅜" carb.sh., 1" coal & inf. coal, 2" carb.sh.,
			112'10½"	7½" m.gy.sh. grading to slts.,

Proximate Analysis, Washability etc.	Recovery per cent	Section Sampled
A/ 35·5		
S.G. 1·582		
Washability:		
Float/ at S.G. A/		
22·3 1·4 11·1		
38·4 1·6 25·3		
9·3 1·8 44·6		
30·0 >1·8 74·7	96'3¾"– 108'4¾"	
Comp of floats at 1·4,1·6,1·8:	89·8%	
M/ 1·9		
V.M./ 26·6		
F.C./ 48·6		
A/ 22·9		
S/ 0·35		
Joules/gm. 26060		
B.T.U/lb. 11210		
A/ 58·0	108'4¾"– 112'9"	
S.G. 1·881	95·7%	
A/ 39·7		
S.G. 1·626		
Washability:		
Float/ at S.G. A/		
30·5 1·4 11·9		
34·9 1·6 24·5		
14·6 1·8 45·9	112'9"– 115'9½"	
20·2 >1·8 80·3	97·3%	
Comp of floats at 1·4,1·6,1·8:		
M/ 1·7		
V.M./ 26·7		
F.C./ 48·2		
A/ 23·4		
S/ 0·35		
Joules/gm 26060		
B.T.U/lb. 11210		

Proximate Analysis, Washability etc.	Recovery per cent	Section Sampled
A/ 47·4	133'2½"– 135'1" 100%	
A/ 56·6	135'1"– 135'10" 100%	
A/ 44·9		
Washability:		
Float/ at S.G. A/		
23·0 1·4 10·6		
27·1 1·6 25·2		
11·1 1·8 47·3		
38·8 >1·8 75·5		
Comp of floats at 1·4,1·6,1·8:	135'10"– 148'6¾" 100%	
M/ 2·4		
V.M./ 26·9		
F.C./ 46·9		
A/ 23·8		
S/ 0·36		
Joules/gm. 25420		
B.T.U/lb. 10940		
S.G. 1·406		

N.S.100	Description
125'4¾"	
	7'9¾" wh. f. sa.,
133'2¾"	4½"(bkn) inf. coal,
	2" d.gy.sh. w ⅛" coal at ⅜",
	2¾"(bkn) inf. coal, 1⅛" l.gy.sh.,
	6⅜"(bkn) coal & inf. coal,
	1¾" carb.sh., ¼" l.gy.sh., ½" coal,
135'1"	1¼" d.gy.sh. w coal lents., 2" inf. coal,
	8" carb.sh., (broken 3" & 6" from top,
135'10"	1" m.gy.slts.,
	7⅛"(bkn.) coal & inf. coal,
	½" l.gy.sh.,
	13⅜"(broken) coal w. m.gy.sh bands up to ½", &
	carb.sh. bands up to ⅜",
	1" m.gy.slts., ¾" d.gy.slts., 1" carb.sh. w cl. lens at
	top & m.gy.slts. (ens in mid., 3¼"(bkn) coal w. ⅛"
	carb.sh. band., 3" coal & inf. coal,
	5"(bkn.) inf. coal w one 1" band m.gy.slts.,
	3¼"(bkn) coal w m.gy.sh. fragments,
	3" m.gy.slts., ⅛" d.gy.sh.,
	½"(p.bkn) coal, 2½"(bkn) carb.sh. & l.gy.sh.,
	⅜" carb.sh.,
	6¾"(bkn) coal & inf. coal,
	1" m.gy.slts. w couple coal lents., 1⅛" (gy.slts.,
	2¼"(bkn) friable l.gy.sh., 5"(broken) coal,
	2"(p.bkn) friable fn.sh. w ⅛" coal nr. top, 1⅞" coal,
	2" friable fawn sh., 1" carb.sh.,
	1½" coal, ½" m.gy.slts.,
	6¾" (partly bkn) coal,
	3" d.gy.sl. ightly carb.slts., 1" fawn sh.,
	1" coal, ¾" l.gy.sh.,
	4"(p.bkn) coal w ¼" m.gy.slts. at ½" & ½" carb.sh. at 1½"
	½" br.sh., 8⅜"(bkn) coal & inf. coal,
	½" carb.sh., ⅛" d.gy.slts. grad. to fawn sh.,
	1¼" inf. coal, ½" carb.sh.,
	3" coal & inf. coal interbedded,
	1½" d.gy.sh.,
	3½"(p.bkn) coal w. ¼" d.gr.sh. at 1½",
	3¾" m.gy.sh., 1¼"(p.bkn) carb.sh., ¾" l.gy.sh.,
	5" carb.sh. w ⅛" l.gy.sh. at top,
	½" d.gy.sh.,
	18⅜" coal w. ⅛" d.gy.sh. at 4⅜", ⅛" l.gy.sh. at 17½",
	(partly broken in bottom 4"),
146'5½"	1½" carb.sh. w br.sh. band in middle,
	7¼" l.gy.slts., carb.sh., ironstone nodules & some
	coal, all very irregularly interbedded,
	1¼" inf. coal, ⅜" carb.sh.,
	4½" friable l.gy.sh.,
	3" d.gy. slts., ⅛" m.gy.sh.,
	1¼" inf. coal, 1" blk.sh., 2" fawn sh.,
	6" inf. coal,
	1⅜" coal, ⅜" carb.sh.,
	2⅜" inf. coal, ⅜" d.gy.sh.,
	6" coal w. few carb.sh. lenses, (partly broken
	in btm. 2"),
	3½" fawn sh.,
	3¾"(p.bkn) inf. coal, 2½" m.gy.sh.,
	2"(bkn) inf. coal, 3½" wh.sh.,
	1⅜"(bkn) coal, 4"(p.bkn) coal w. ½" carb.sh. at btm.,
	1½" br.sh., 5" carb.sh. w. ¼" m.gy.sh. at 1½", (4"(bkn)
	coal at 2½", 3½" wh.sh.,
	1½" carb.sh., 1" l.br.sh., 1⅞"(bka) carb.sh.,
	⅜" d.gy.sh.,
	8⅜"(bkn) coal with carb.sh. bands,
	2'd gy.sh. w coal lents in top 1",
156'2"	1" m.gy.sh., 1" d.gy.sh., ¼" coal, 1" interbd. lents.
	carb.sh. w. coal w ¼" m.gy.slts. at top, ⅛" d.gy.slts.,

Proximate Analysis, Washability etc.	Recovery per cent	Section Sampled
A/ 57·6	151'9¾"– 153'6¾" 100%	
A/ 40·4		
Washability:		
Float/ at S.G. A/		
25·2 1·4 9·4		
32·5 1·6 25·3		
12·2 1·8 48·8		
30·1 >1·8 75·0		
Comp of floats at 1·4,1·6,1·8:	153'6¾"– 165'9¾" 100%	
M/ 2·2		
V.M./ 27·0		
F.C./ 47·1		
A/ 23·7		
S/ 0·41		
Joules/gm 25380		
B.T.U/lb. 10920		
S.G. 1·467		

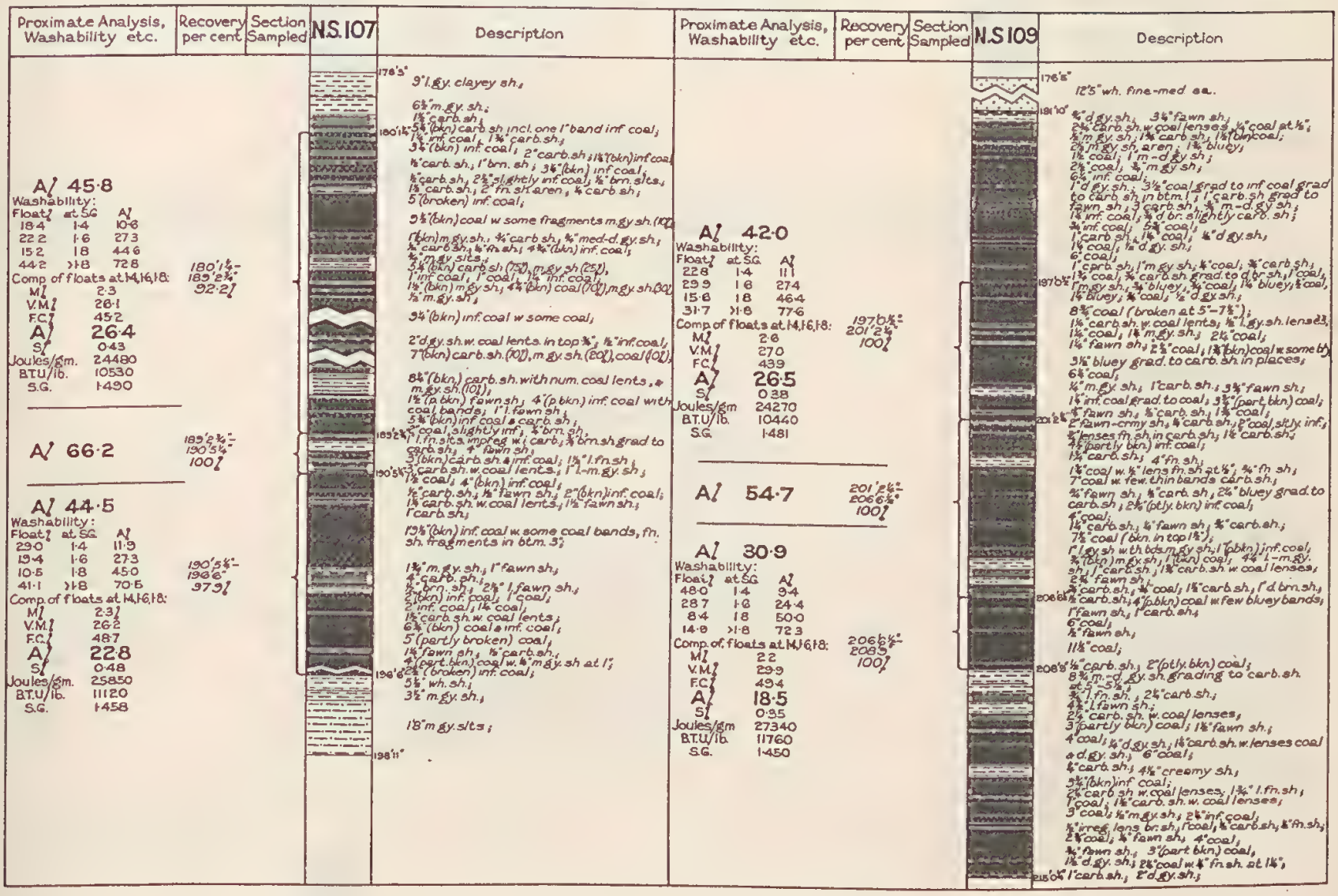
Proximate Analysis, Washability etc.	Recovery per cent	Section Sampled
A/ 43·9		
Washability:		
Float/ at S.G. A/		
26·7 1·4 10·0		
23·1 1·6 29·6		
11·3 1·8 46·4		
38·9 >1·8 76·3		
Comp of floats at 1·4,1·6,1·8:	137'6¾"– 143'5" 100%	
M/ 1·7		
V.M./ 27·2		
F.C./ 48·5		
A/ 24·6		
S/ 0·42		
Joules/gm. 25180		
B.T.U/lb. 10830		
S.G. 1·477		
A/ 59·9	143'5"– 146'2" 100%	
A/ 35·8		
Washability:		
Float/ at S.G. A/		
31·4 1·4 8·3		
26·4 1·6 27·4		
9·4 1·8 48·0		
32·8 >1·8 75·4		
Comp of floats at 1·4,1·6,1·8:	146'2"– 152'4½" 100%	
M/ 1·5		
V.M./ 27·4		
F.C./ 49·9		
A/ 21·2		
S/ 0·40		
Joules/gm. 26450		
B.T.U/lb. 11380		
S.G. 1·452		

N.S.101	Description
143'7½"	
	78' interbd. l.gy. & km.gy. slts.,
151'3⅜"	½" lent. band l.gy. fine sa. w pebbles abt ½" diam.,
	¼" carb.sh. w lens m.gy.sh. in mid., lents. in btm ¼",
151'9¾"	2' (or slts.), 2" carb.sh. w. few coal lents.,
	4½" inf. coal,
	1" carb.sh., 1" d.gy.sh., 1"(bkn) inf. coal, 1¼" coal,
	1" d.gy.sh. grad. to carb.sh., ¾" coal, ½" d.gy.sh.,
	1¼" inf. coal, 1¼" m.gy.sh., 3" carb.sh. w. ⅛"
	lens of (.gy.slts.), 1" coal), ¾" m.gy.slts.,
153'6¾"	2½" carb.sh. w ¼" coal & ⅛" d.gy.sh. in mid.,
	6⅜"(p.bkn) coal w few carb.sh. bands,
	⅜" m.gy.sh.,
	6¼" coal grad. to inf. coal in btm. 2", w 4" l-m.gy.sh.
	at base,
	4" coal, ¼" d.gy.sh.,
	1¼" coal, 1" d.gy.sh.,
	6¼" coal w. ⅛" carb.sh. at 3", 1" carb.sh. at 4¼",
	1⅛" br.sh. grad. to carb.sh., 2"(bkn) coal,
	¼" d.gy.sh., ½" coal,
	7¾"(partly bkn) coal w. few bands inf. coal,
	1½" d.gy.sh., 4"(broken) inf. coal,
	1⅜" blk.sh.,
	3" inf. coal w ¼" d.gy.sh. at 6¼",
	1" d br.sh., 2¼" fawn sh.,
	¾" carb.sh., 3¾"(bkn) coal & inf. coal,
	1½" fawn sh., 1" fawn sh., & coal, 1" fawn sh.,
	2½" coal, ⅛" fn.sh., ¼" l.gy.sh., ¾" d.gy.sh. grad.
	to carb.sh., few l. carb. nodules, 5"(bkn.) coal with
	some inf. coal, 5" fawn sh.,
	¾" coal, 1⅛" fawn sh. w. ⅜" carb.sh. in middle,
	9" coal w. ¼" fawn sh. at 5", ¼" d.gy.sh. at 4½",
	1½" fawn sh., ⅛" l.gy.sh.,
	4⅜"(bkn) coal,
	2" carb.sh., ¼" fawn sh.,
	1⅛" inf. coal, 4¾" coal w. inf. coal bands,
	⅛" m.gy.sh., 4"(bkn) coal, slightly inf.,
	3½" m.gy.sh., 2" carb.sh. w. ¼" coal at middle,
	2" br.sh. grad. to fawn sh. grad. to fawn slts.,
	½" carb.sh., ¾" coal, 2" carb.sh. w lens (gy.sh. at
	top, 2" fawn sh., 1" coal, ¼" d br.sh. slightly carb.,
	½" br.sh., 1¼" carb.sh. w. few coal lents.,
	9¼" (broken) coal,
	5½" coal w. ¼" br.sh. at 1¼",
	4¼"(p.bkn) coal w. ¼" carb.sh. at base,
165'3¾"	1" fn.sh. grad. to carb.sh., 1⅛"(p.bkn) coal w. ⅜"
	carb.sh. & fr. btm., 1" carb.sh. w coal lents., ⅜" m.sh.,
	½" carb.sh., 1¼" coal w ¼" carb.sh. at base, 1" m.gy.sh.,
	2⅛" carb.sh., ¼" d.gy.sh.,
	3½" l.fn.sh.,
	1¼" carb.sh.,
	3½"(p.bkn) coal w few carb.sh. bands,
	½" d.gy.sh., 3¼" inf. coal,
	½"(bkn) coal & inf. coal, 1" coal, 1⅛" carb.sh. w.
	coal lents., 2½"(bkn) carb.sh. w coal lents., some
	l.fo.sh., 2" l.fn.sh., ¼" d.gy.sh. slightly carb.,
	1⅛" coal, slightly inf., 1¼" carb.sh. w coal lents.,
	4½" (broken) coal & inf. coal,
	2" fawn sh.,
	6½" (broken) coal,
	1½" fawn sh. grad. to br. in btm. ¾",
	3¼" carb.sh. w. irreg lens br.sh. at 1",
	3½" (partly bkn) coal, ¾" d.gy.sh.,
	¼" coal, 1¼" fawn sh. grad. to br.sh.,
	3¾"(bkn) coal;
172'11"	5' d.gy.sh. slightly carb. grad. to slts. in btm. 1½",

N.S.106	Description
138'2¾"	9" d.gy.sh. with l carb., some slickensiding btm 4",
	2" carb.sh. w few coal lents.,
	3½" coal grad. to carb.sh. w coal lents.,
	5' m-d.gy.sh., few coal lents. in btm 1',
	5½" carb.sh. w coal lenses,
	1½" carb.sh., 1" d.gy.sh.,
	5½" friable l.gy.sh.,
	3½" friable fawn sh.,
	½" d.gy.sh., ½" br.sh., 2½" carb.sh. w coal lenses,
	½" m.gy.sh., 2" carb.sh. w coal lenses, 1½" fn.sh. seen,
	¼" carb.sh., 1" d.gy.sh., 1" carb.sh.,
	1" coal, 1½" carb.sh. w. coal lents., 1'l.-m.gy.sh.,
137'6¾"	1½" carb.sh., 4½" inf. coal,
	½" d.gy.sh., 2" coal, ½" carb.sh.,
	1¼" d.gy.sh., 2" carb.sh. w. ⅛" br.sh. at 1½",
	1½" coal, 3" carb.sh. w. coal lenses,
	2½" coal, 1" fawn sh.,
	1¼" inf. coal (bkn), 3½" d. br.-gy.sh. w ¾" coal at 1",
	5½" coal w ⅛" carb.sh. at 2½",
	¼" carb.sh. grad. to m.sh., 3" carb.sh. w coal lents.,
	1" coal, ½" br.sh., ¾" coal, ½" d.br.-gy.sh.,
	2½" (bkn) coal, 1" fawn sh.,
	3" coal, 1¼" fawn sh.,
	2⅛"(bkn) coal w. inf. coal, 2"(bkn) inf. coal,
	¾" bluey, 2" coal,
	½" d.gy.sh., 4½" coal w lens d.gy.sh. at 1½",
	1½" m.gy.sh. w irreg. coal lens., 1¼" coal,
	2½" carb.sh. in top 1" grad. to fawn sh.,
	1½" coal, 1¼" l.fn.sh., ¼" carb.sh.,
	1¼" bluey,
	8¼" coal w few bands inf. coal,
145'9"	1' carb.sh. w coal lents.,
	2¾" l.fn.sh.,
	4½" coal, ⅜" fawn sh.,
	2" inf. coal, 2¼" fawn sh.,
	¾" carb.sh., 3¼" coal,
	2"(bkn) inf. coal, ¾" carb.sh., ½" l.gy.sh., ¾" carb.sh.,
	5½" l.gy.-fawn sh.,
146'2"	¼" inf. coal, ¾" l.gy.sh., ½" coal, ¼" fn.sh.,
	8½" coal w. br.sh. parting at 2", gr.sh lens at 7",
	1½" fn.sh., 2¼" carb.sh. w coal lenses,
	4½" (partly bkn) coal,
	¾" carb.sh., ¼" fawn sh., 1" carb.sh., ⅜" fawn sh.,
	7" coal w many carb.sh. lam.,
	2¾" l.gy.sh. in top ½" grad. to d.gy.sh., few coal lents.,
	¼" l.gy.sh., 2¾" (gy.sh. grad. to m.gy.sh w coal
	lenses in mid., 3½" coal & bluey bds. w ¼" carb.sh in mid.,
	1¼" fawn sh., 4½"(pb) coal & bluey w ¼" ca.sh at top,
	2½" br.sh. in top ½" grad. to fawn sh., ¾" carb.sh.,
	4½" coal,
	¾" carb.sh., ½" d.gy.sh.,
	9" coal,
	½" fawn sh.,
	8¼" coal,
	7½"(bkn.) coal w. small amt. inf. coal,
152'4½"	carb.sh.,
	6' d.gy.sh. grad. to m.gy.sh.,
	28⅜" m.gy.slts.,
155'6⅜"	

SEAM SECTIONS
WESTFALEN Nº 2 —— TOP SEAM

FIG. 5



SEAM SECTIONS
WESTFALEN Nº2 —— MIDDLE SEAM

FIG. 6

N.S. 94

A/ 56·0 S.G. 1·853

Washability:

Float/	at S.G.	A/
16·3	1·4	9·5
22·3	1·6	28·2
12·7	1·8	43·2
48·7	>1·8	76·1

Comp. of floats at 1·4, 1·6, 1·8: 187′4½″ – 135′10¾″ = 96·9%

M/ 2·0
V.M/ 26·1
F.C/ 46·4
A/ 25·5
S/ 0·40
Joules/gm. 24960
B.T.U./lb 10740

	Description
183′7¼″	3″m gy sh grading to dk gy. in btm 1″;
	1¼″l gy slts., 2½″dgy sh;
	4½″(p.bkn) coal w bands of bluey up to ¾″;
	¾″inf coal, ¾″carb sh., 1¾″(bkn) carb sh w coal bands; 4″brn sh., ⅛″inf coal., 2″(pt. bkn) coal,
	¾″inf coal; ½″(bkn) coal, 2½″m gy sh w coal lents.,
	7″l. gy sh;
	3½″m gy sh w l gy sh lenses in top 1″;
	3″carb sh w num coal lam & lents grad to inf cl 1″;
	2½″coal, 2″d gy sh;
	f″carb sh; 1″inf coal; 1″carb sh; ½″coal (irreg.
187′4¾″	lens), 1″sh; ½″carb sh, 2″l gy sh grad to leathery sh; ½″coal, 1″(bkn) coal; 3¾″inf coal,
	1¼″(bkn) coal, 3″coal,
	1″l gy sh., 2½″boulder;
	2″coal, inf in part;
	6½″(bkn in top 4″) coal,
	½″l-med gy slts,
	4½″(bkn) coal & bluey,
	3½″med gy sh;
	4½″l-med. gy. sh;
	2″inf coal; 2″slightly carb. sh; ½″m gy sh;
	½″l gy. sh lenses in m gy sh; 9¾″m gy sh;
	1″carb sh., 1¾″m gy sh., ¾″carb sh
	1″l-med. gy sh; 1″carb sh; ½″l-m gy sh;
	f″carb sh; 1″coal; 1″carb sh; ½″l-m gy sh;
	2″carb sh; 1¾″inf. coal; 1½″carb sh;
	2½″l gy sh, 1¼″l gy sh w irreg coal lens,
	1½″coal, 1¼″carb sh w m gy sh bd ¼″fr top;
	½″l gy sh, irreg lens,
	10″(p.bkn) inf coal w bds carb sh;
	3½″carb sh with coal lents,
	2½″(bkn) inf. coal; ½″carb sh with coal band,
	3″l gy sh; ¾″carb sh;
	f″coal; 1¼″m gy sh,
	1¾″coal; ½″fn sh; 2½″coal,
195′10¾″	½″fn sh; 1½″(p.bkn) coal; 1½″(bkn) carb sh; 1¼″carb sh w coal lents grad to inf cl in part; f″carb sh; 1″bluey;
	1½″m gy sh; 1⅛″coal; ¾″m gy sh; ¼″coal; ¾″m gy sh;
	¾″carb sh grad to inf cl; ¾″m gy sh; ½″(bkn) inf coal;
	4″d gy sh; 2¼″l gy grad to fawn sh; ¼″carb sh.
197′1¾″	1″l-m gy sh; 1″(p.bkn) carb sh; 2″l-med gy sh w few coal lents;

N.S. 95

A/ 58·6 S.G. 2·014 — 285′5″ – 287′5½″ = 100%

A/ 52·7 S.G. 1·818

Washability:

Float/	at S.G.	A/
19·6	1·4	10·2
22·4	1·6	28·4
16·4	1·8	44·1
41·6	>1·8	72·7

Comp. of floats at 1·4, 1·6, 1·8: 287′5½″ – 229′4½″ = 100%

M/ 1·4
V.M/ 25·3
F.C/ 46·2
A/ 27·1
S/ 0·33
Joules/gm. 24400
B.T.U./lb 10500

	Description
283′3½″	1′3″carb sh with coal lents, coaly material coked,
	10½″d gy. sh,
286′6″	f″bluey; 6½″coal & inf coal, the coal showing some signs of coking;
	2¾″d gy sh; ¾″inf coal,
	3½″carb sh;
	4½″inf. coal, partly coked with carb. sh lents;
	2″(p.bkn) carb sh, ½″m gy. sh; f″carb sh; ¾″m gy
287′5½″	sh grad to slt s, ¾″inf coal, ptly coked; 2¾″l gy sh,
	7½″(p.bkn) coal with some carb sh bands;
	f″m gy f. sa; 1½″coal w carb sh bands,
	¾″l gy. f. sa; 1½″m gy f. sa; 4″(p.bkn) coal;
	3½″coal with carb sh bds; ½″l. gy slts,
	4¾″(partly bkn) coal;
	2½″d gy sl grad to carb sh in places, w coal lents,
	1½″l gy slts, 2½″carb sh;
	1½″l brn. slts; 1″carb sh; 2¾″coal;
	½″m gy slts, 2″inf coal; ½″m gy sh,
	½″carb sh; ½″m gy. sh; f″carb sh.,
	2½″(bkn) coal,
	4½″l-m gy sh grad to slts near btm;
	1½″coal & carb sh bds; 1½″l gr. sh
	3½″(bkn) inf coal & some carb sh;
	1″coal, 2″carb sh, ½″d gy slts;
	11″coal with several carb sh bands totalling 2″;
293′4½″	lenses of l gy sh 6″ & 9″ from top;
	3½″l gy sh;
	4½″carb sh & inf coal w m gy sh lenses;
	1″l gy sh; 4½″inf coal w carb sh & m gy sh.
	lenses; ¾″fawn sh.;
	6¾″carb sh w coal lents;
	1½″d gy sh; ½″carb sh & coal, 1⅛″m gy sh grad to slts w ¼″coal ¾″from btm; 2¾″(p.bkn) coal;
	1″m gy sh; 3″fawn sh;
296′4½″	7″inter bd. m gy sh & carb sh w several coal lenses;

N.S. 98

A/ 44·7 S.G. 1·741

Washability:

Float/	at S.G.	A/
18·8	1·4	9·3
24·8	1·6	26·8
13·4	1·8	46·2
43·0	>1·8	76·1

Comp. of floats at 1·4, 1·6, 1·8: 233′6¾″ – 24′3″ = 100%

M/ 1·1
V.M/ 25·5
F.C/ 47·9
A/ 25·5
S/ 0·40
Joules/gm 25200
B.T.U./lb 10840

	Description
228′3″	9″(bkn) coked coal with wh veinlets of $CaCO_3$, & wh. clay,
	1′9″coked carb sh,
	2½″l-m. gy. sh with d gy. sh band at 2″;
	6″coked inf. coal;
	3¾″coked carb sh w lenses coked coal;
	1½″d gy sh; 1¼″bd. carb sh & coal slightly coked;
	1½″d gy sh; 2″carb sh with coal lents;
	3″coal w few carb. sh. bds; 2″coal w ¼″blk. sh. 1″fr.
	btm; 2″l gy sh.,
	4″(broken) coal w. some carb. sh. bands;
233′6¾″	4¾″l gy. slts. w. ⅛″carb sh. band at ½″;
	10″(partly broken) coal;
	¾″m gy. sh; ¾″coal; ½″d gy sh; 1¼″coal,
	¾″m.-d gy. slts.; 1¼″d gy. slts.;
	1′1¾″coal with ½″carb sh at 2¼″, 1″carb sh at 5″,
	¾″d gy slts at 7″;
	5¾″m-d gy sh with ¾″(bkn) coal at 3″;
	1½″carb sh w coal lents, ¾″l gy slts, ¾″m gy sh,
	1″d gy sh; ½″l gy sh; 3½″carb sh w l gr sh lenses
	at f″ fr btm, coal lents in btm ¾″; ½″l gy slts, 1¼″inf
	coal, ¾″carb sh; ¾″m gy slts; 1¼″carb sh;
	4½″(pt. bkn) inf coal, 3″carb sh grad to d gy sh,
	2½″l gy slts becoming coarser in btm 1′; ¾″carb sh,
	1½″l gy sh; 1″carb sh; 2½″coal, 1″inf coal,
	3″carb sh w coal lenses in btm 1½″; ½″m gy slts,
	10″inf coal w carb sh bds., ¾″l gy slts at 5″
	from top;
	1′2″m gy slts grading to l gy slts., ½″carb sh,
	¾″d gy slts; 2½″carb sh; ¾″m gy slts;
	¾″carb sh; 1″coal; ½″m gy slts; 3¾″coal;
241′3″	½″carb sh, 5¾″inf coal,
	3½″d gy sh w coal lents,
	1½″(bkn) coal, 2″(bkn) inf coal, 1″m gy slts. with
	4″carb sh & ½″fr top; 3½″d gy sh grad to carb sh with
	coal lents, ½″coal & ½″fr top; 3½″m-d gr sh, 3¾″l gr sh
	grad to slts, 7½″carb sh grad to d gy sh in
242′1½″	places with 1″l gy sh at 2½″ & with ¾″coal at
	¾″ & 4½″.

N.S. 100

	Description
283′9″	2′1″coked carb sh with 1″m gy sh band at 1′3″;
	6″blk. sh;
	1⅛″blk. slts, 1½″coked carb sh,
	2½″coked coal, 3″coked carb sh w ½″d gy sh at
	1½″, ¾″coked coal at 2″, 1″d gy. sh;
	8″coked coal with carb sh. in top 2½″
288′	2½″l gy sh;
	4½″slightly coked coal w d brn sh lens ¾″fr btm,
	1¼″d gy slts, impreg with iron carb; 3½″coal;
	3½″(bkn) coal slightly coked, ¼″carb sh,
	1″coal, ¾″l brn sh,
	1′5¼″coal w ½″d gy sh at ½″, ¾″carb sh at 6½″,
	½″l gy slts at 9½″, ¾″carb sh at 10″, grading to
	inf. coal w carb sh in btm 3″;
	1¾″fn sh; 2¼″carb sh w coal lents,
	3½″d gy slts grad to carb sh w two ¾″bds. of fn sh.
	near btm; 2½″coal, 1⅛″fn sh w coal & carb sh
	lents, 5″carb sh w ¾″l gy slts at 2″ & at 3¾″;
	3¾″inf coal;
	1″d gy slightly carb sh, 1″d gy sh;
	4½″l gy slts w ¾″l gy sh at 1″;
	2″carb sh; 4¾″inf coal,
	½″fawn sh, 1⅛″carb sh; ½″coal, ½″brown sh,
	1⅛″coal w br sh streak in mid, ¾″carb sh, ½″l gy sh, ½″
	carb sh, 5″coal w ¾″fn sh at 1″, w few carb sh bands,
	½″fn sh; ½″coal, ½″carb sh; 3½″coal w few carb
	sh bds; 1½″carb sh grad to slts, 2″l gy sh;
	¾″carb sh; ½″m gy sh; ½″coal, ½″irreg lens m-d
295′4½″	gy sh, ½″carb sh, 1⅛″coal, 1″carb sh, 1″inf coal,
	½″m gy sh; ½″carb sh; ½″fawn sh; 3½″inf coal grad
	to coal & sh w d lents in btm 1′; ½″fawn sh
	9½″inf coal w irreg ½″lens 1″br sh at 1′; grad to
	carb sh in btm 1″
	1½″l gy sh,
	5½″coal w ½″carb sh at top & ½″d gy sh at 3½″;
	½″d gy sh, 4½″m gy sh w ½″coal at 2″;
	½″(bkn) coal, ½″carb sh; 1½″d gy sh;
	1½″m gy sh w coal bands; 1″fawn sh,
	3½″d gy sh; 2″l-bedded lam of l gr. & m gr slts,
	3″d gy sh
299′	3″d gy slightly carb sh w coal lents;

N.S. 101

A/ 41·6

Washability:

Float/	at S.G.	A/
28·1	1·4	10·5
27·5	1·6	25·8
12·6	1·8	44·0
31·8	>1·8	74·4

Comp. of floats at 1·4, 1·6, 1·8: 279′½″ – 283′10¾″ = 100%

M/ 2·0
V.M/ 23·7
F.C/ 51·6
A/ 22·7
S/ 0·41
Joules/gm. 26010
B.T.U./lb. 11190
S.G. 1·476

A/ 61·8 — 283′10¾″ – 285′9¾″ = 100%

A/ 48·9

Washability:

Float/	at S.G.	A/
20·7	1·4	10·1
23·1	1·6	26·2
15·0	1·8	45·6
41·2	>1·8	73·6

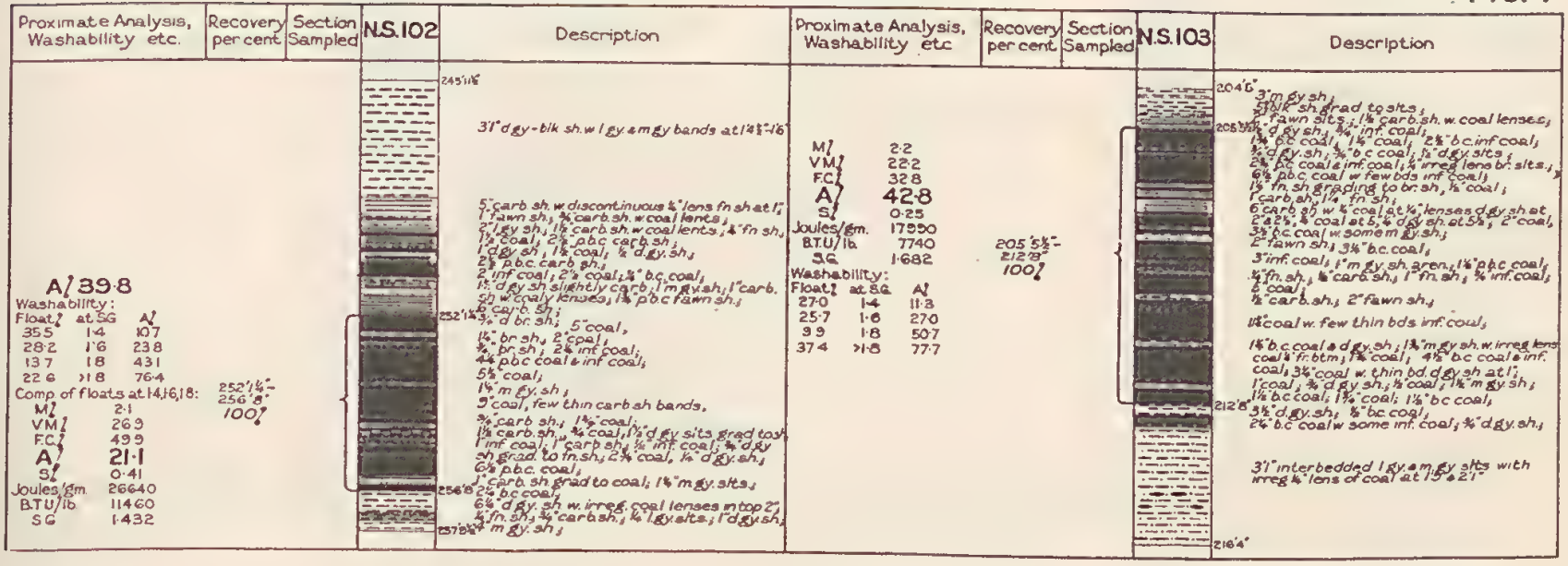
Comp. of floats at 1·4, 1·6, 1·8: 285′9¾″ – 289′3″ = 100%

M/ 2·4
V.M/ 26·7
F.C/ 45·2
A/ 25·7
S/ 0·42
Joules/gm 24610
B.T.U./lb. 10550
S.G. 1·489

	Description
275′6″	2′7″carb sh & coal bands showing coking effects;
	11⅛″carb sh;
279′1¾″	5″black sh; ½″l gy sh;
	1″coal, 2″bluey; 1⅛″coal,
	1½″carb sh; 1″coal; ½″br grad to fawn sh;
	1¾″carb sh w ¼″coal at btm; 1″fawn sh;
	7½″coal & inf coal;
	2½″l gy sh w twin carb sh bands in btm ¾″;
	1¼″inf coal; ¾″d gy sh;
	3½″l gy sh w ¼″carb sh at 1½″ fr top;
	3″interbedded inf coal & carb sh;
	8″coal;
	1½″carb sh w coal lents; 2″coal & inf coal;
	¼″br sh;
	1′1″coal w num carb sh lam;
283′10¾″	1″carb sh w coal lents; 1″m gy sh; 1⅛″inf coal,
	1½″carb sh; ¼″coal; 1″med grad to l gy sh; ¾″carb
	sh; 1¼″l gy sh; 1¼″carb sh; ¼″l gy sh; 4″carb sh;
	1¼″coal; 1¼″l gy sh; 1″coal,
	3½″carb sh w ¼″l gy. sh. 1″ from top;
	2″inf coal; 1″coal;
	2″carb sh w coal lents; 3¾″l gy sh w lenses
288′9¾″	carb sh; 1½″carb sh;
	3¾″coal; ¾″lent″ l gy sh band,
	1″carb sh; 1½″l gy sh grad to sh pren; ½″carb sh,
	2″inf coal w l gy sh bd ¾″wide 1¼″from top; ½″m gy sh;
	6¾″inf coal w few coal bands;
	2″coal w irreg lens cb. sh in mid.; ¾″m gy sh;
	2″m gy sh; 1″gy grad to cr sh; 2¾″carb sh,
	½″l gy sh; 2½″coal; 1¼″irreg lens m gy sh;
	1¾″coal; ½″fawn sh;
	2½″coal, ½″fawn sh;
	8½″(p.bkn) coal 65%, carb sh. 30%, l gy sh. 5%;
	1″sh. sh w coal band ½″fr top, ½″m gy sh;
289′9″	6½″coal w m gr. sh band ¾″wide 5″fr top;
290′0″	2¾″l gy sh;
	¾″irreg band carb sh;
	3′0½″d gy., med gy, & carb sh bands w few coal lents;
293′1″	

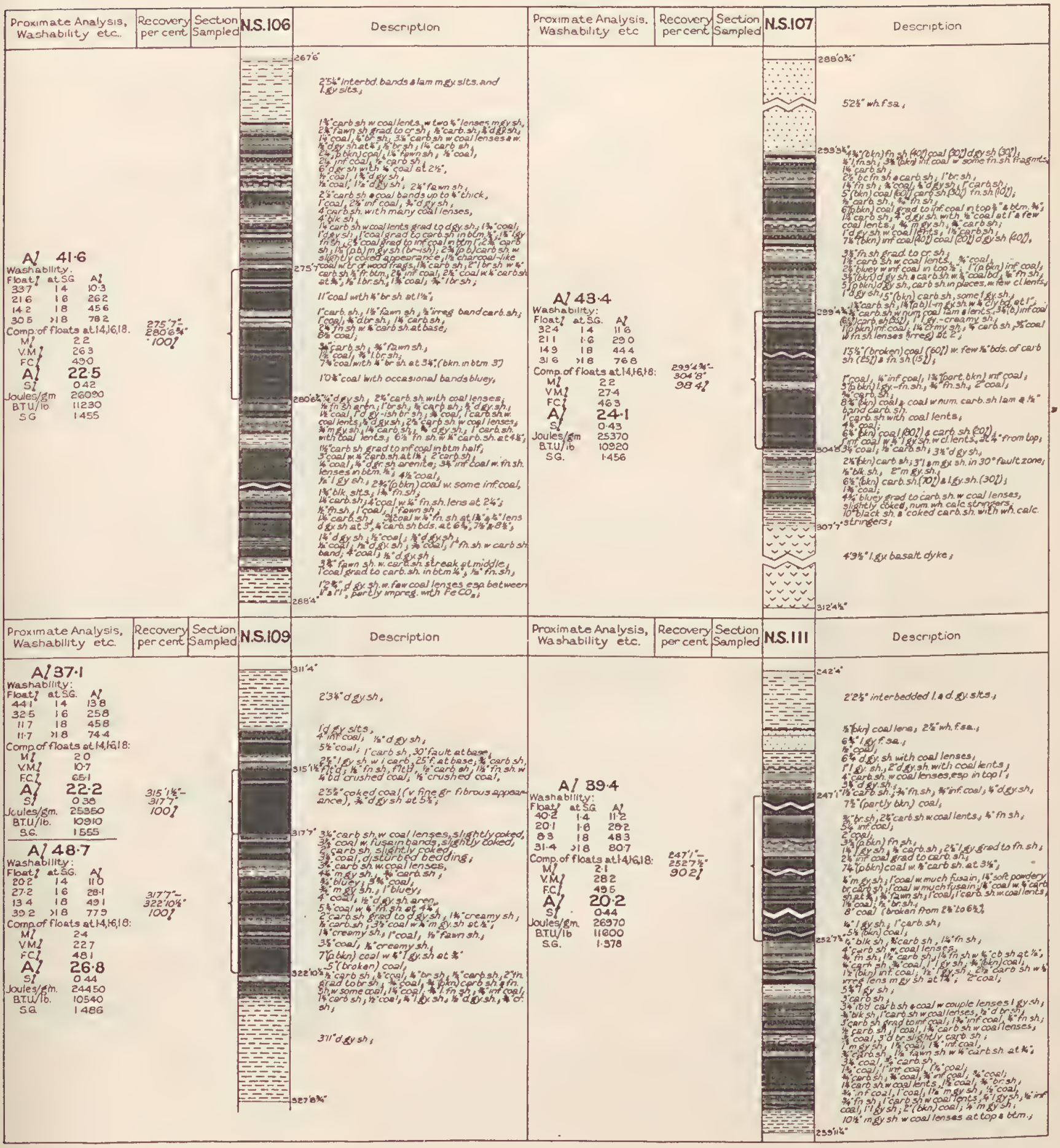
SEAM SECTIONS
WESTFALEN Nº 2 —— MIDDLE SEAM

FIG. 7


Proximate Analysis, Washability etc.
Recovery per cent
Section Sampled
N.S.102
Description
Proximate Analysis, Washability etc
Recovery per cent
Section Sampled
N.S.103
Description
A/ 39·8
Washability:
Float/ at SG A/
35·5 1·4 10·7
28·2 1·6 23·8
13·7 1·8 43·1
22·6 >1·8 76·4
Comp of floats at 1·4/1·6/1·8:
M/ 2·1
VM/ 26·9
F.C./ 49·9
A/ 21·1
S/ 0·41
Joules/gm. 26640
B.T.U/lb. 11460
S.G 1·432
252'1¼"-256'8" 100/
245'11"
31" d.gy-blk sh. w l.gy. & m.gy bands at 14½"-1'6"
5" carb. sh. w discontinuous ¾" lens fn sh at 1";
1" fawn sh; ¾" carb. sh. w coal lenses;
2" l.gy sh; 1½" carb sh. w coal lenses; ¼" fn sh;
1½" coal; 2½" p.b.c carb. sh;
1" d.gy. sh; 1½" coal; ½" d.gy. sh;
2½" p.b.c. carb sh;
2" inf coal; 2" coal; ¾" b.c. coal;
1½" d.gy sh slightly carb; 1" m.gy.sh; 1" carb.
sh w coaly lenses; 1¾" p.b.c fawn sh;
5½" carb. sh;
252'1¼"- ½" d br. sh;
5" coal,
1¼" br sh; 2" coal;
¾" br sh; 2¾" inf coal;
4¼" p.b.c coal & inf coal;
5½" coal,
1¾" m.gy. sh;
9" coal, few thin carb sh bands,
¾" carb sh; 1½" coal;
1½" carb. sh; ¾" coal; 1½" d.gy silts grad to sh
1" inf coal; 1" carb sh; ½" inf. coal; ¾" d.gy
sh grad. to fn. sh; 2¾" coal; ½" d.gy. sh;
6¾" p.b.c. coal,
1" carb. sh grad to coal; 1¾" m.gy. silts;
256'8" 2½" b.c coal
6¾" d.gy. sh w. irreg. coal lenses in top 2";
¼" fn. sh; ¾" carb sh.; ¼" l.gy silts; 1" d.gy sh.
257'6¼" m.gy. sh;
M/ 2·2
VM/ 22·2
F.C./ 32·8
A/ 42·8
S/ 0·25
Joules/gm. 17550
B.T.U/lb. 7740
S.G 1·682
Washability:
Float/ at S.G. A/
27·0 1·4 11·3
25·7 1·6 27·0
9·9 1·8 50·7
37·4 >1·8 77·7
205'5½"-212'8" 100/
204'6"
3" m.gy sh
2½" lk sh grad to silts;
2" fawn silts; 1½ carb. sh. w. coal lenses;
205'3½" d.gy sh; ¼" inf. coal;
1¼" b.c. coal; 1¼" coal; 2½" b.c. inf coal;
½" d.gy. sh; ¾" b.c coal; ½" d.gy silts;
2¾" b.c. coal & inf. coal; ¼" irreg lens br. silts;
6½" p.b.c. coal w few bds inf. coal;
1½" fn. sh grading to br. sh; ½" coal;
1" carb. sh; 1¼" fn. sh;
6" carb. sh w ¼" coal at ½" lenses d.gy. sh at
2" 2½"; ¼" coal at 5"; ¼" d.gy sh. at 3½"; 2" coal;
3½" b.c. coal w some m.gy. sh;
2" fawn sh; 3¼" b.c. coal;
3" inf. coal; 1" m.gy. sh. aren.; 1½" p.b.c. coal;
¾" fn. sh; ½" carb. sh; 1" fn. sh; ¾" inf. coal;
2" coal;
½" carb. sh; 2" fawn sh;
1¼" coal w. few thin bds inf. coal;
1½" b.c. coal & d.gy. sh; 1¾" m.gy sh. w. irreg lens
coal & fn. btm; 1¾" coal; 4½" b.c. coal & inf.
coal; 3¾" coal w. thin bd. d.gy sh at 1";
1" coal; ¾" d.gy. sh; ½" coal; 1¼" m.gy sh;
1½" b.c. coal; 1¾" coal; 1½" b.c. coal,
212'8" 3½" d.gy. sh; ½" b.c. coal;
2¼" b.c coal w some inf. coal; ¾" d.gy. sh;
3'1" interbedded l.gy. & m.gy silts with
irreg ¼" lens of coal at 1'9 & 2'1"
216'4"

SEAM SECTIONS
WESTFALEN Nº 2 —— MIDDLE SEAM

FIG. 8


Proximate Analysis, Washability etc..
Recovery per cent
Section Sampled
N.S.106
Description
A/ 41·6
Washability:
Float/ at SG A/
3·37 1·4 10·3
2·16 1·6 26·2
1·42 1·8 45·6
3·05 >1·8 78·2
Comp: of floats at 1·4, 1·6, 1·8.
M/ 2·2
V.M/ 26·3
FC/ 49·0
A/ 22·5
S/ 0·42
Joules/gm 26090
B.T.U./lb 11230
S.G 1·455
275'7"–280'6¾" 100/
267'6"
2'5¾" interbd. bands & lam m.gy slts. and l.gy slts.;
1¾" carb sh w coal lents., w two ¾" lenses m.gy sh,
2¾" fawn sh grad to cr sh; ½" carb. sh; ¾" d.gy sh,
1½" coal, ¾" br. sh, 3½" carb sh w coal lenses & w. ½" d.gy sh at ¾"; ½" br sh; 1¼" carb sh,
2¾" (p.bkn) coal, 1·½" fawn sh; ½" coal,
2¼" inf coal; ½" carb sh,
6" d.gr sh with ¾" coal at 2½",
½" coal, 1¾" d.gy sh,
½" coal, 1½" d.gy sh; 2¾" fawn sh;
2½" carb sh & coal bands up to ¾" thick,
1' coal, 2¾" inf coal; ¾" d.gy sh,
4' carb sh. with many coal lenses,
4' blk sh,
1¼ carb sh w coal lents grad to d.gy sh; 1¾" coal,
1' d.gy sh; 1' coal grad to carb sh in btm ½"; 1¾" (gy fn sh; 2½" coal grad to inf coal in btm (2¾" carb sh; 1¾" (p.bl) m.gy sh (br-ish); 2¾" (p.b) carb sh w slightly coked appearance; 1¾" charcoal-like coal w/ br of wood frags; 1¾" carb sh; 2"1 br sh w ¾" carb sh ½" fn btm, 2¾" inf coal; 2½" coal w ¼" carb sh at ¾"; ½" br sh; 1¾" coal; ¾" br sh;
275'7"
11" coal with ¼" br sh at 1½";
1' carb. sh; 1½" fawn sh; ¾" irreg band carb sh;
1' coal; ¾" d br sh; 1¼" carb sh,
2¾" fn sh w ¾" carb sh at base,
8½" coal;
¾" carb sh; ¾" fawn sh,
½" coal; ¾" l br sh;
7¾" coal with ¼" br sh at 3½" (bkn in btm 3")
1'0¾" coal with occasional bands bluey,
280'6¾"
¼" d gy sh; 2¾" carb sh with coal lenses; ½" fn sh aren; 1' br sh; ½" carb sh; ¾" d gy sh,
1½" coal, 1' d gy-ish br sh; ¾" coal, 1' carb sh w coal lents, ½" d gy sh; 2¾" carb sh w coal lenses, ¾" m gy sh; 1¼" carb sh; ¾" d gy sh; 1' carb sh with coal lents; 6½" fn sh w ¼" carb sh at 4½";
1½" carb sh grad to inf coal in btm half,
3" coal w ¾" carb sh at 1½"; 2" carb sh;
¼" coal, ¾" d gr sh arenite; 3¼" inf coal w. fn sh lenses in btm ¾"; 4½" coal,
½" l gy sh.; 2½" (p bkn) coal w. some inf coal,
1¾" blk. slts.; 1¾" fn sh;
1¼" carb sh; 4" coal w ¼" fn sh lens at 2¼";
½" fn sh; 1" coal; 1" fawn sh;
1¼" carb sh; 2¾" coal w ¼" fn sh at 1¾"; ¾" lens d gy sh at 5"; ¼" carb sh bds. at 6¼", 7½" & 8½";
1¼" d gy sh; ½" coal; ½" d gy sh,
½" coal; ½" d gy sh; ¾" coal; 1' fn sh w carb sh band; 4" coal; ½" d gy sh,
3¾" fawn sh w. carb sh streak at middle;
1' coal grad to carb sh in btm ¼"; ½" fn sh;
1'2¾" d gy sh w. few coal lenses esp between ½" & 1", partly impreg. with $FeCO_3$;
288'4"
Proximate Analysis, Washability etc
Recovery per cent
Section Sampled
A/ 43·4
Washability:
Float/ at SG A/
3·24 1·4 11·6
2·11 1·6 29·0
1·49 1·8 44·4
3·16 >1·8 76·8
Comp. of floats at 1·4, 1·6, 1·8: 299'4¾"–304'8" 98·4/
M/ 2·2
V.M/ 27·4
FC/ 46·3
A/ 24·1
S/ 0·43
Joules/gm 25370
B.T.U./lb 10920
S.G. 1·456
N.S.107
Description
288'0¾"
5'2½" wh. f sa.;
299'3¾"
¾" (bkn) fn sh (40/) coal (30/) d gy sh (30/);
¼" l fn sh; 3¾" (bkn) inf coal w some fn sh fragmts;
1¾" carb sh,
2½" bf fn sh & carb sh; 1" br sh,
1¾" fn sh; ¾" coal; ¾" d gy sh; 1" carb sh;
5" (bkn) coal (60/) carb sh (30/) fn sh (10/);
½" carb sh; ¾" fn sh;
6" (p bkn) coal grad to inf coal in top ½" & btm ¾";
1¼ carb sh; 4" d gy sh with ½" coal at 1" & few coal lents.; ¾" m gy sh; ¾" carb sh;
1' d gy sh w coal lents; 1½" carb sh;
7¾" (bkn) inf coal (40/) coal (20/) d gy sh (40/),
299'4¾"
3½" fn sh grad to cr sh;
1½" carb sh w coal lents.; ¾" coal;
2¾" bluey w inf coal in top ½"; 1" (p bkn) inf coal;
3½" (bkn) d gy sh & carb sh w ½" coal bd; ½" fn sh;
5" (p bkn) d gy sh., carb sh in places, w few cl lents;
1' d gy sh; 5" (bkn) carb sh, some l gy sh;
1¾" carb sh; 1¼" (p b) l-m gy sh w ¼" cly bd at 1";
¾" carb sh w num coal l'ams & lents.; 3¾" (p) inf coal (6/) carb sh (30/); 1" l gy.-creamy sh;
1" (p bkn) inf coal; 1¼" dmy sh; ¾" carb sh; ¾" coal w fn sh lenses (irreg) at 2";
1'5½" (broken) coal (60/) w. few ½" bds. of carb sh (15/) & fn sh (15/);
1" coal; ¼" inf coal; 1¾" (part. bkn) inf coal;
3" (p bkn) l gy.-fn sh; ¾" fn sh.; 2" coal;
¾" carb sh;
8¾" (bkn) coal & coal w num. carb sh lam @ ½" band carb sh.
1' carb sh with coal lents;
4½" coal;
6¾" (bkn) coal (80/) & carb sh (20/);
1" inf coal w ¼" l gy sh w cl lents., at 4" from top;
3¾" coal; ½" carb sh; 3½" d gy sh,
2½" (bkn) carb sh; 3'1 & m gy sh in 30° fault zone;
½" blk sh.; 2" m gy sh;
6½" (bkn) carb sh (70/) & l gy sh (30/);
1¾" coal;
4½" bluey grad to carb sh w coal lenses, slightly coked, num wh calc stringers;
10" black sh & coked carb sh with wh calc stringers;
307'7"
4'9½" l gy basalt dyke;
312'4½"
Proximate Analysis, Washability etc.
Recovery per cent
Section Sampled
N.S.109
Description
A/ 37·1
Washability:
Float/ at SG A/
4·41 1·4 13·8
3·25 1·6 25·8
1·17 1·8 45·8
11·7 >1·8 74·4
Comp of floats at 1·4, 1·6, 1·8:
M/ 2·0
V.M/ 10·7
FC/ 65·1
A/ 22·2
S/ 0·38
Joules/gm. 25350
B.T.U./lb. 10910
S.G. 1·555
315'1½"–317'7" 100/
A/ 48·7
Washability:
Float/ at SG. A/
2·02 1·4 11·0
2·72 1·6 28·1
1·34 1·8 49·1
3·92 >1·8 77·9
Comp of floats at 1·4, 1·6, 1·8:
M/ 2·4
V.M/ 22·7
FC/ 48·1
A/ 26·8
S/ 0·44
Joules/gm. 24450
B.T.U./lb. 10540
S.G. 1·486
317'7"–322'10½" 100/
311'4"
2'3¼" d gy sh,
1' d gy slts,
4" inf coal; ½" d gy sh;
5½" coal; 1' carb sh, 30° fault at base;
2½" l gy sh w i carb, 25° f. at base; ¾" carb sh,
1½" fri'd; 1¾" fn sh, fri'd; ½" carb sh; 1¼" fn sh w ¼" bd crushed coal; ½" crushed coal,
2'5½" coked coal (v fine gr fibrous appearance), ¾" d gy sh at 5½";
315'1½"
317'7" 3¼" carb sh w coal lenses, slightly coked,
3½" coal w. fusain bands, slightly coked,
4" carb sh, slightly coked,
3½" coal, disturbed bedding;
3¾" carb sh w coal lenses,
4¼" m gy sh; ¾" carb sh;
¾" bluey; 3¾" coal,
¾" m gy sh.; 1" bluey;
4" coal; ½" d gy sh aren.,
5¾" coal w ¼" fn sh at 4¼";
2" carb sh grad to d gy sh; 1¾" creamy sh;
½" carb sh; 3½" coal w ¼" m gy sh at ½";
1¾" creamy sh; 1" coal; ½" fawn sh.;
3½" coal; ¾" creamy sh.;
7" (p bkn) coal w ¼" l gy sh at ¾"
5" (broken) coal;
322'10½"
½" carb sh; ¾" coal; ¼" br sh; ¼" carb sh; 2" fn grad to br sh; ¾" coal; ¾" (bkn) carb sh & fn sh w some coal; 1¼" coal; ¼" l fn sh; ¼" inf coal; 1¼ carb sh; ½" coal; ¼" l gy sh; ½" d gy sh; ¾" d sh;
3'11" d gy sh;
327'8¾"
Proximate Analysis, Washability etc.
Recovery per cent
Section Sampled
A/ 39·4
Washability:
Float/ at SG A/
4·0·2 1·4 11·2
2·0·1 1·6 28·2
8·3 1·8 48·3
3·1·4 >1·8 80·7
Comp. of floats at 1·4, 1·6, 1·8:
M/ 2·1
V.M/ 28·2
FC/ 49·5
A/ 20·2
S/ 0·44
Joules/gm. 26970
B.T.U./lb 11600
S.G. 1·378
247'1"–252'7½" 90·2/
N.S.111
Description
242'4"
2'2½" interbedded l. & d. gy. slts.;
½" (bkn) coal lens; 2½" wh. f sa.;
6¾" l gy f. sa.;
½" coal;
6¾" d gy. sh with coal lenses;
1' l gy. sh.; 2" d gy. sh with coal lents;
4" carb sh w coal lenses, esp in top l;
3¾" d gy. sh;
247'1" 1½" carb sh.; ¾" fn sh, ¾" inf coal; ¼" d gy sh;
7½" (partly bkn) coal;
¾" br. sh; 2½" carb sh w coal lents; ¼" fn sh;
5¼" inf coal;
2" coal;
3½" (p bkn) fn sh;
1¼" l gy sh; ¾" carb sh; 2½" l gy grad to fn sh;
2¼" inf coal grad to carb sh;
7¼" (p bkn) coal w. ½" carb sh at 3½";
¼" m gy sh; 1' coal w much fusain, 1½" soft powdery br carb sh; 1' coal w much fusain; ½" coal w ¼" carb sh at ¾"; ¾" fawn sh; 1' coal; 1' carb sh w coal lents;
1½" coal; ½" br sh;
8" coal (broken from 2½" to 6½");
¼" l gy sh; 1" carb sh;
5½" (bkn) coal;
252'7½"
½" blk sh; ½" carb sh, 1¼" fn sh;
4" carb sh w coal lenses;
¾" fn sh; 1½" carb sh; 1¼" fn sh w ¼" cb sh at ½";
¼" carb sh; ¾" coal; 1" l gy sh; ¼" (bkn) coal;
1½" (bkn) inf coal; ½" l gy sh; 2½" carb sh w ½" vrns lens m gy sh at 1¼"; 2" coal;
5¾" l gy sh;
3" carb sh;
3¼" (p) carb sh & coal w couple lenses l gy sh;
¾" blk sh; 1" carb sh w coal lenses; ½" d br sh;
3" carb sh grad to inf coal; 1¾" inf coal; ¾" fn sh;
½" carb sh; 1" coal; 1¼" carb sh w coal lenses;
½" coal; 3" d br slightly carb sh;
1' m gy sh; 1½" coal; 1¾" inf coal;
¾" carb sh; 1¼" fawn sh w ¼" carb sh at ¾";
3¼" coal; ¾" carb sh;
1½" coal; 1" inf coal; 1¾" coal;
¼" carb sh; ¾" coal; ¾" inf coal; ¾" coal;
1¼" carb sh w coal lents.; 1½" coal; ¾" br sh;
¾" inf coal; 1' coal; 11" m gy sh; ½" coal;
¾" fn sh; 1' carb sh w coal lents; ¼" l gy sh; ½" inf coal; 1' l gy sh; 2" (bkn) coal; ¼" m gy sh;
10¼" m gy sh w coal lenses at top & btm.;
259'11¼"

WESTFALEN Nº 2 MINE AREA, DINMORE • COLLIERY SECTIONS

TOP SEAM

FIG. 9

A

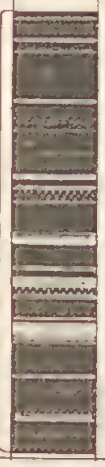
Proximate Analysis, Washability etc.

A‡ 37·9
S.G. 1·612
Washability
Float‡ at S.G. A‡
36·0 1·4 10·7
31·3 1·6 27·9
7·6 1·8 44·0
25·1 >1·8 74·1
Comp of floats 1·4, 1·6 1·8
M‡ 2·0
V.M.‡ 27·4
F.C.‡ 49·3
A‡ 21·3
S‡ 0·38
Joules/gm 26660
B.T.U./lb 11470
S.G. 1·447

Recovery per cent

Section Sampled

10'7½"



Description

2" coal, ¼" med gy sh;
3½" coal w some bluey bands,
1" fawn sh; 2¾" coal, ½" l gy sh;

1'1½" coal w few penny bands;

1" fawn sh; 3" coal,
3" bluey w coal lenses,
2" coal, ¾" d gy sh;

1'0½" coal w few inf bands,

1½" med gy sh; 1¾" coal,
1" fawn sh; 2¾" bluey,
½" coal, ¾" med gy sh,
8¾" coal;

1" carb sh; 2¾" fawn sh;
6½" coal;
1" l br grad to fawn sh; 2" coal,
2" fawn sh; 1" boulder,
2" inf coal; ¾" fawn sh; ¾" carb sh;
5½" coal grad to inf coal in places;
½" carb sh & d gy sh; ¾" coal;
4" fawn sh; ½" carb sh;
¾" l gy sh; ⅜" coal; ¾" l gy sh;
3" coal w some penny bands,
1" fawn sh; 3" coal
2" bluey, 4" coal;
3" bluey grad to carb sh; ⅛" fawn sh;
1¾" coal;
8" coal & inf coal.

B

Proximate Analysis, Washability etc.

A‡ 46·1
S.G. 1·729
Washability
Float‡ at S.G. A‡
28·1 1·4 10·5
24·1 1·6 27·1
6·4 1·8 42·3
41·4 >1·8 72·8
Comp of floats 1·4, 1·6 1·8
M‡ 2·2
V.M.‡ 27·2
F.C.‡ 49·8
A 208
S‡ 0·39
Joules/gm. 26690
B.T.U./lb. 11480
S.G. 1·443

Recovery per cent

Section Sampled

10'9½"

Description

3" fawn sh;
5¾" carb sh w thin fawn sh bands & ½" lenses,
½" coal, ¼" br sh, 1" carb sh,
½" br sh; 7" inf coal;
1'1 br-gy sh; 2¾" coal grad to inf coal; ¼" m gy sh;

12" coal w number of penny bands;

1" med gy sh; 3⅜" coal w 1" inf coal at 1";
1" m br-gy sh;
11" coal,

¾" fawn sh, 2½" coal,
1" m gy sh; 3" coal;
1¼" fawn sh; 1⅛" carb sh,
8¼" coal grad to inf coal in places;

3½" fawn sh,
3½" coal;
1½" inf coal; ¾" fawn sh; ¼" carb sh;
2¼" coal; 2¼" fawn sh;
9¼" coal;

6" fawn sh;
1" inf coal, ½" fawn sh, ½" coal, ½" br-gy sh;
8¾" coal,
1" fawn sh,
8½" bluey & coal bands;
¾" fawn sh; 3½" coal grad to inf coal;
¾" br sh; 5½" coal & bluey bands.

MIDDLE SEAM

C

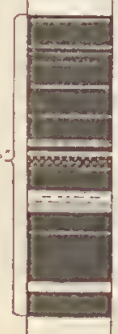
Proximate Analysis, Washability etc.

M‡ 2·5
V.M.‡ 22·9
F.C.‡ 33·1
A‡ 41·5
S‡ 0·28
Joules/gm. 18250
B.T.U./lb 7850
S.G. 1·678
Washability
Float‡ at S.G. A‡
26·9 1·4 9·7
31·6 1·6 27·2
10·7 1·8 44·0
30·8 >1·8 76·8

Recovery per cent

Section Sampled

7'2"



Description

8¾" coal w 1" d gy sh at 1";

¾" l gy slts; 1⅛" coal; ½" med gy slts,

15¼" coal w ¼" l br slts at 2½" and ⅛" br slts at 9";

¾" m gy sh,
1¼" coal & inf coal;
¾" fawn sh, 1¼" med gy sh,
1½" coal, 1¼" fawn sh,
3½" inf coal, ¾" med gy sh,
6" coal,
4½" med gy sh,
¼" carb sh, 1½" fawn sh,
3¾" coal;
¾" med gy sh,

1'2" coal,

2¾" l-med gy sh;
6¾" coal.

D

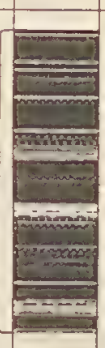
Proximate Analysis, Washability etc.

M‡ 2·6
V.M.‡ 25·8
F.C.‡ 29·7
A‡ 41·9
S‡ 0·27
Joules/gm. 18025
B.T.U./lb 7750
S.G. 1·661
Washability
Float‡ at S.G. A‡
36·5 1·4 10·6
18·8 1·6 28·7
13·5 1·8 45·2
31·2 >1·8 76·3

Recovery per cent

Section Sampled

7'3"



Description

1" coal, ¼" d gy sh;
7" coal;
1'1 gy slts; 1½" coal; ½" l gy sh;
7½" coal w ¼" fawn sh at 2",
½" l gy slts; 1½" inf coal,
7¼" coal;
1¼" l gy sh; 3½" coal & inf coal;
1" l gy sh; 2¼" carb sh w coal lenses;
1'1 gy sh; 4½" coal w ⅜" inf coal at btm;
2½" inf coal w ¼" m gy sh at 1½";
5¼" coal,
4¼" l-med gy sh;
3½" inf coal w ¼" d gy sh at 1",
4½" coal,
½" l-med gy sh; 2" inf coal,
8" coal w ¼" med gy sh at 1½" & at 4";
½" l gy sh;
4½" coal;
1½" d gy sh; 2" l gy sh;
1" carb sh; 4" coal,
1" carb sh

E

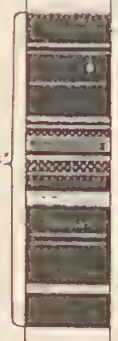
Proximate Analysis, Washability etc.

A‡ 38·7
S.G. 1·657
Washability
Float‡ at S.G. A‡
30·0 1·4 9·7
26·4 1·6 29·8
9·2 1·8 45·2
34·4 >1·8 75·6
Comp of floats 1·4, 1·6 1·8
M‡ 2·0
V.M.‡ 27·5
F.C.‡ 48·1
A‡ 22·4
S‡ 0·40
Joules/gm 26020
B.T.U./lb 11190
S.G. 1·456

Recovery per cent

Section Sampled

7'5½"



Description

¼" leathery sh;
4½" inf coal w coal bands;
4" coal,
¾" fawn sh, 1½" coal, ⅛" br sh;

1'6½" coal w few penny bands, ½" l br sh at 8¾";

1½" fawn sh; 1" coal;
⅛" carb sh; 1¼" coal; 1½" bluey,
1" fawn sh; 3" carb sh w coal lenses;
1¼" coal; ¼" gy sh;
3¾" inf coal w coal lenses;
2" br sh; 4¾" coal w inf bds in top half;
4¼" l gy sh;

1'10¼" coal w bds inf coal & few penny bands sh, w ½" med gy sh at 7¼" & at 10";

2½" l gy sh;
9½" coal.

F

Proximate Analysis, Washability etc.

No sample taken

Recovery per cent

Section Sampled

Description

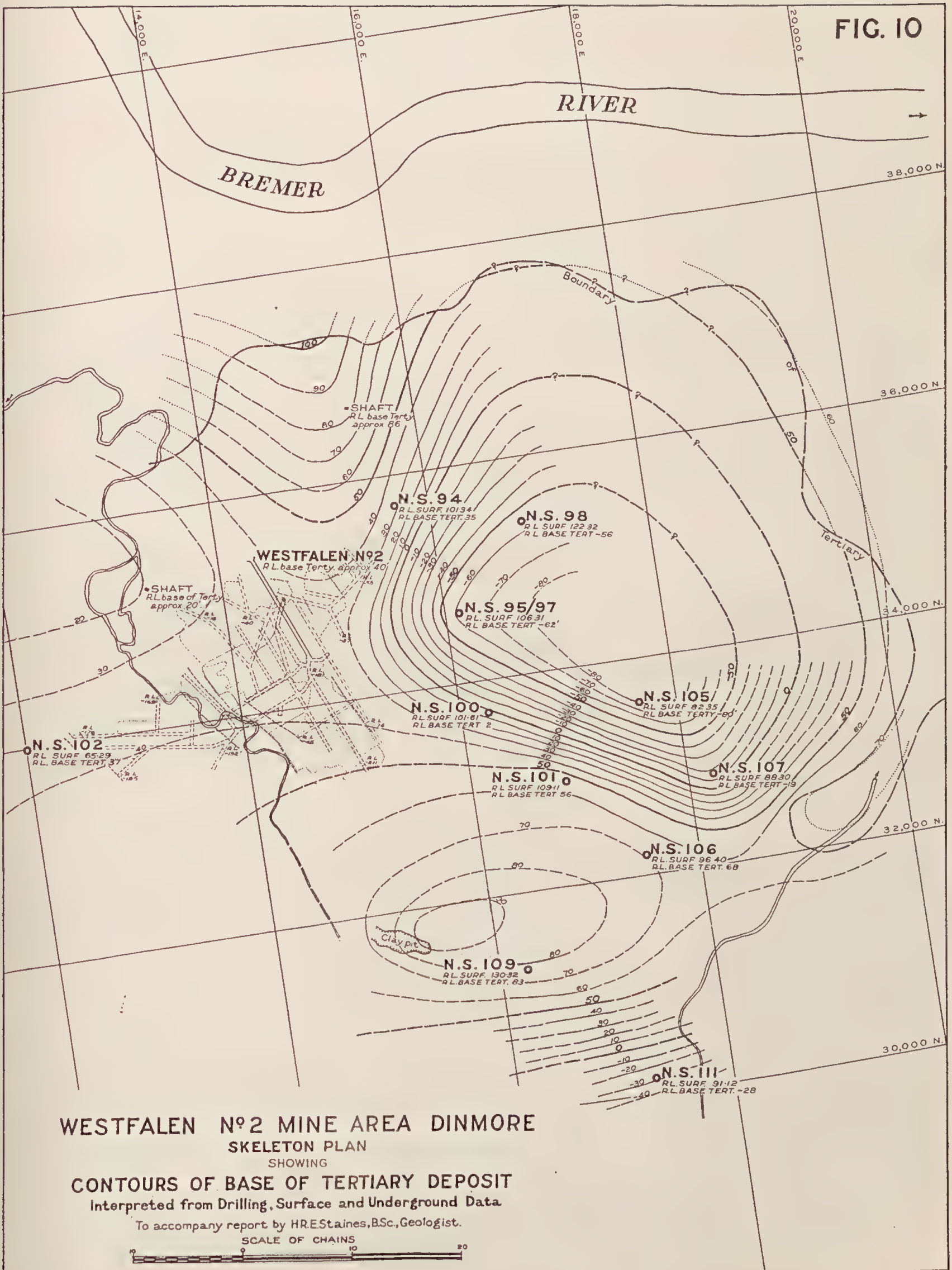
9¾" coal;
1" l gy slts; 1" coal,
1'd gy sh; 1¼" d gy sh w coal lenses;

1'9½" coal w ¼" fawn sh at 2" & ⅛" carb sh at 1'6";

7½" l-med gy sh w ⅝" coal at 1¼",

5½" d gy sh w coal lenses,
1 coal; ⅛" carb sh; ¾" coal,
1¼" carb sh; 1" med gy sh; 1½" inf coal;
7" med gy sh w coal lenses,
4" l-med gy sh,
¾" coal; ⅞" med gy sh; 5½" coal,
¾" l-med gy sh;
9½" carb sh w coal lenses, a 1" coal at 3¼";
½" l gy sh;
5" bedd carb sh & coal, w ¼" fawn sh at 3½",
3" l gy sh;
7½" coal & inf coal w ¼" med gy sh at 1½".

FIG. 10



WESTFALEN Nº2 MINE AREA DINMORE

SKELETON PLAN

SHOWING

CONTOURS OF BASE OF TERTIARY DEPOSIT

Interpreted from Drilling, Surface and Underground Data

To accompany report by H.R.E. Staines, B.Sc., Geologist.

SCALE OF CHAINS

0 10 20

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 285

COPPER MINING IN THE CLONCURRY MINERAL FIELD

By

J. H. BROOKS, B.Sc., Geologist

BRISBANE
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1957

COPPER MINING IN THE CLONCURRY MINERAL FIELD

By J. H. Brooks, B.Sc., Geologist.

This report by Mr. J. H. Brooks, Geologist, on "Copper Mining in the Cloncurry Mineral Field" is based on inspections carried out as opportunity offered between August and December, 1955, and during May, 1956. In all 31 of Cloncurry's "small mines" which were operating at the time of inspection, or had produced ore since 1953, are described.

The present activity is due to the ruling high price of copper and to the opening of the copper smelter at Mount Isa in 1953. The combined output of the small mines in 1955 exceeded 1,000 tons. Following the introduction of a quota system by Mount Isa Mines Ltd. in May, 1956, future production will be limited to 900 tons of ore monthly.

It is revealed that the ore being worked in the majority of the mines is secondary, though in a few cases primary ores enriched by secondary sulphides are being exploited. Unenriched primary ores are in general too low grade for exploitation by small operators.

Deposits considered to have the best prospects are the "Lady Annie" at Paradise Valley, discovered as recently as 1937, and the "Mount Olive" where an important new shoot has been discovered as a result of recent underground prospecting.—A.K.D.

Introduction.

This report deals with small producing copper mines and is exclusive of the *Mount Isa* mine. Field inspections were restricted to operating mines or mines which have produced appreciable quantities of ore since 1953. The inspections were carried out between August and December, 1955, and during May, 1956, in conjunction with other field work in the Cloncurry Field.

With the opening of a copper smelter at Mount Isa early in 1953 the production of copper from small mines rose from almost nil to over 500 tons annually. Production in 1955 exceeded 1,000 tons. The provision of a copper smelter on the Field treating custom ore enabled many old mines to be reopened and lower-grade ores to be profitably mined. Production was given a further impetus by the sharp rise in the price of copper which reached record levels in the 1955-56 period. The cut-off grade for small scale production now ranges from 5 per cent. to 9 per cent. Cu according to distance from Mount Isa (based on a price of £400 Australian per ton of copper). The average grade of ore mined in 1955 was 10 per cent. Cu. Future production will be restricted to approximately 900 tons of ore per month following the introduction of a quota system for the purchase of custom ore by Mount Isa Mines Ltd. in May, 1956.

In earlier years (before 1943) the main production of copper centred in the southern and eastern portions of the Field but since that time the locus of production has shifted to the western and northern areas. Testing by company interests of deposits such as *Trekelano* and *Mount Elliott* which were large producers of copper in earlier years has given inconclusive results and has not led to the reopening of these mines. Considerable production in 1955 came from the *Mount Oxide* mine but the ore has been extracted from stopes in previously developed sections of the mine and with the exhaustion of these stopes in sight no additional reserves have been proved. In a few cases, e.g. *Edna May* and *Hampden* much of the recent production has come from mine dumps. In general, underground exploration and development has been rather limited. At the *Lady Annie*, development has proved that the lode maintains its size and grade to a depth of over 100 ft. and the mine is one of the most important potential producers of copper on the Field. Indicated and inferred reserves amount to 48,000 tons. At the *Mount Olive*, underground exploration has proved a new ore-shoot beneath old workings and at the *Megaphone*, a relatively small, but rich deposit of secondary ore, has been developed in recent years. With the exception of these mines no discoveries of additional reserves of ore of significance have been made. However, there is scope for exploration on several deposits which could lead to the discovery of further ore.

Most of the mines are still being worked in secondary copper ore although primary sulphides enriched by secondary sulphides and oxide are being mined at the *Mount Olive, Manxman, Kings Cross, Woolondonga, Referee,* and *Lillimay*. In general the grade of the primary sulphide ore is too low to allow economic development by small scale mining operations. Previously Mount Isa Mines Limited encouraged the production of ore with a highly siliceous gangue by paying for silica in ores containing 30 per cent. silica and over in excess of iron, but this has now been discontinued. Ores containing more than 0·01 per cent. nickel are not acceptable to the Company and this has stopped production from a number of small mines mostly located in the Ballara-Mount Isa area.

The numerous small copper deposits of the Cloncurry Field consist mainly of fissure lodes occurring in faults which are usually well defined by a quartz infilling. The mineralised faults are related to various systems of faulting and occur in all rock formations older than the Upper Proterozoic. The larger deposits of the Field of which only the *Mount Oxide, Hampden,* and *Lady Annie* are included in

this report, are also related to faulting but are mainly of the disseminated replacement type of deposit associated with shale.

The following is a list of the individual leases on which reports are given. The dates of field inspections are also listed:—

Paradise Valley Area.
- Lady Annie (with plan and section), 21st and 22nd September, 1955; 16th May, 1956.
- Lady Jean—22nd September, 1955.
- Paramount—22nd September, 1955.

Mount Oxide Area.
- Mount Oxide—8th and 9th November, 1955; 11th and 12th May, 1956.
- Trioxide—9th November, 1955.
- Mount Gordon—10th November, 1955.
- Mammoth (Kangaroo)—12th May, 1956.

Calton Hills Area.
- Mount Maggie (with plan)—20th August, 1955.
- MacLeod Hill—23rd November, 1955.
- Mount Kelly—24th November, 1955.
- Mount Clarke—24th November, 1955.

Kajabbi Road Area.
- Yamamiller (with plan)—16th November, 1955.
- Referee (with plans and section)—16th November, 1955; 22 May, 1956.
- Mount Olive (with plan and section)—14th November, 1955; 17th May, 1956.
- Lillimay (with plan and section)—15th November, 1955; 22nd May, 1956.
- Manxman—17th May, 1956.

Argylla Area.
- Blockade (Argylla) (with area map, plan and section)—20th and 21st October, 1955; 23rd May, 1956.
- Blockade North (with plan)—23rd May, 1956.
- Blockade South—23rd May, 1956.
- Megaphone (with plan and section)—21st October, 1955; 23rd May, 1956.

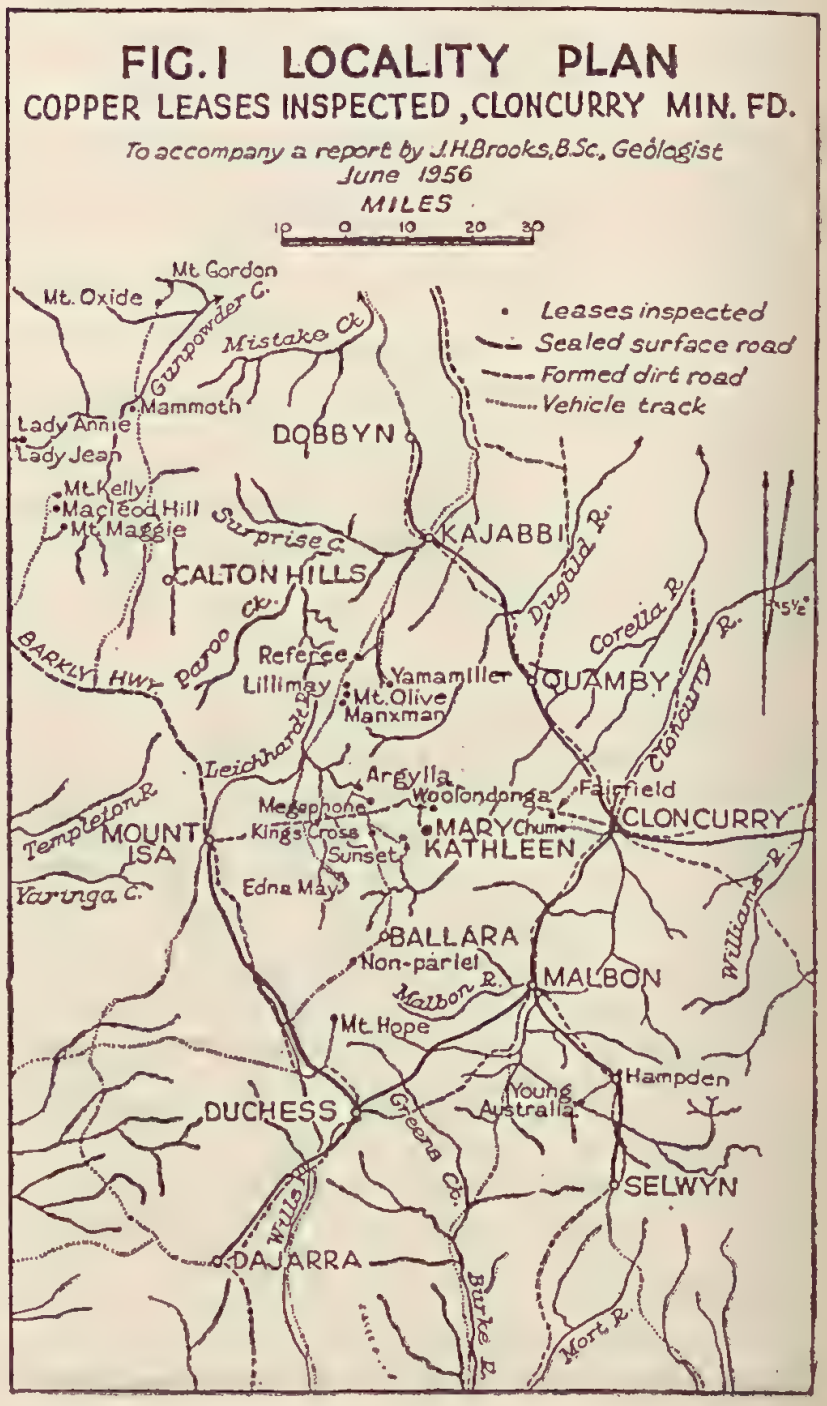
Ballara Area.
- Edna May (with plan and section)—14th December, 1955.
- Kings Cross (with plan and section)—12th December, 1955; 24th May, 1956.
- Sunset—30th November, 1955, 13th December, 1955.
- Woolondonga (with plan)—25th November, 1955.
- Nonpariel—1st November, 1955.

Cloncurry Area.
- Chum—28th October, 1955.
- Fairfield—28th October, 1955.

Duchess Area.
- Mount Hope (with area map)—5th and 6th September, 1955.
- Binna Burra—5th and 6th September, 1955.
- Mount Hope North—5th and 6th September, 1955.

Kuridala Area.
- Young Australia (with plan)—24th November, 1955.
- Hampden.

The Paradise Valley group, the Mount Oxide group, "Mammoth," "Mount Maggie," Manxman," and "Mount Hope" are not fully described as these have been the subject of previous published reports (see list of references). Production figures are taken from official reports by the Cloncurry Mining Warden. A locality map (Fig. 1) accompanies this report. Plans and sections of mines have been drawn from rapid chain and compass surveys.



PARADISE VALLEY.

Lady Annie.

This lease is held by G. H. Sanderson. It is situated 108 miles by road from Mount Isa. The access from Mount Isa comprises 71 miles by the Barkly Highway to Yelvertoft dip, 11 miles by the "Thorntonia" station track, thence 26 miles by fair to rough graded track to the mine. For a description of the local geology and the outcrops of the copper deposits of Paradise Valley, reference should be made to a report by A. K. Denmead (1937).

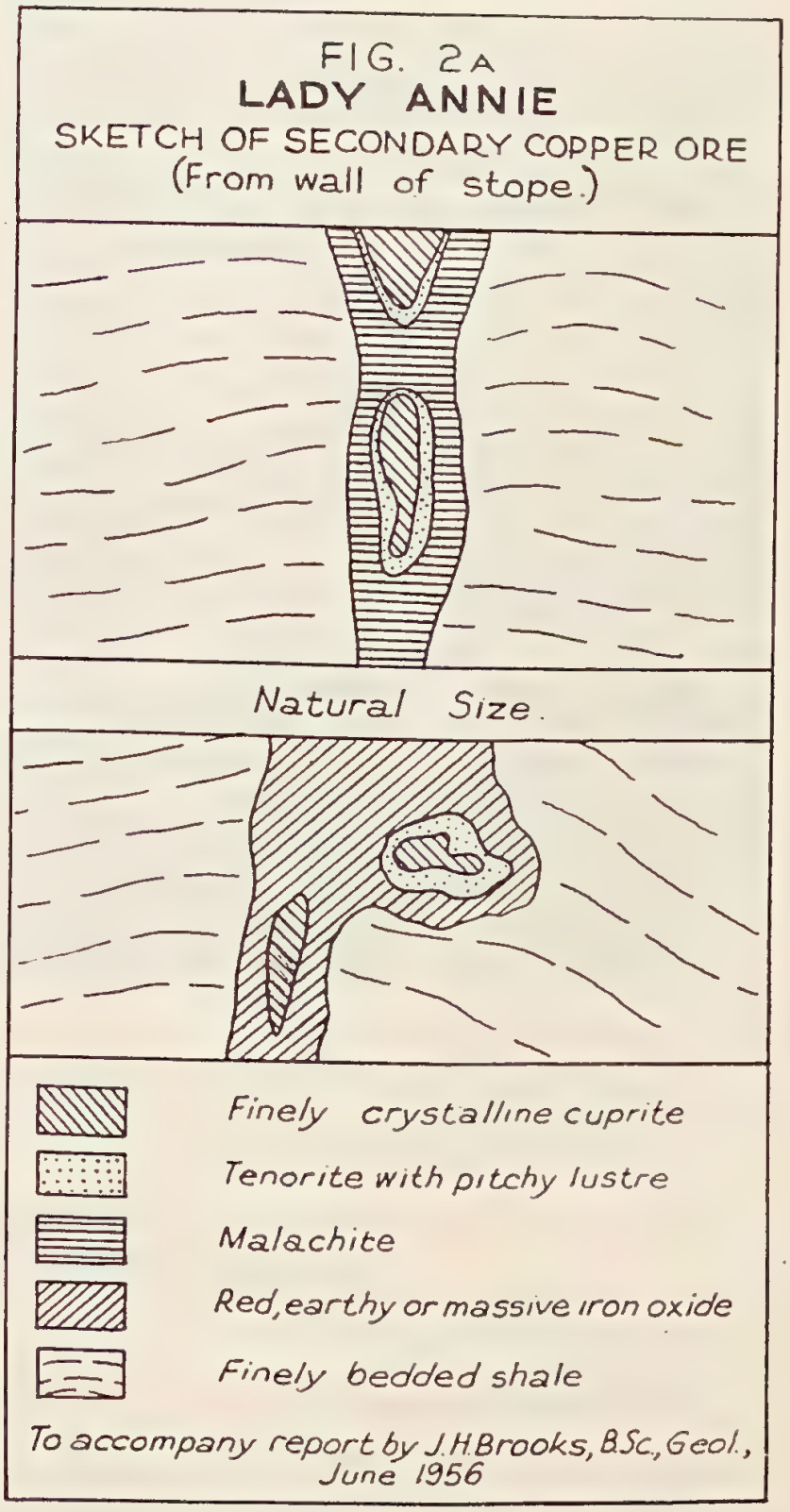
Production.—The deposit was discovered in 1937 but the grade of copper was barely high enough to offset the transport costs caused by the remote location, and only small, intermittent production took place up to 1952. The subsequent change in economic conditions was sufficient to encourage production and since 1953 the mine has been one of the largest producers of copper in the Cloncurry Field.

PRODUCTION TABLE.

—	Ore.	Copper.	Percentage.
	Tons.	Tons.	Cu.
1937–1952 ..	328	39·4	12·0
1953 ..	1,314	132·3	10·0
1954 ..	2,011	179·3	8·9
1955 ..	1,801	192·5	10·7
Total ..	5,454	543·5	9·9

Geology.—The deposit occurs as a disseminated replacement of shales adjacent to a defined fault plane which marks the foot-wall of the copper ore and is the primary control of copper mineralisation. The fault is arcuate in outline and ranges in strike from north 70 deg. west to east-west and dips southerly at 50 deg. to 55 deg. It is marked in part by the occurrence of red earthy hematite. This band of hematite has been used as a foot-wall marker in mining operations. The finely bedded shales are brecciated in part and elsewhere are contorted, particularly in proximity to the foot-wall shear. In the exposures in the open-cut and the adjacent stope the overall structure of the shales appears to be that of an anticlinal flexure with a rolling pitch in a southerly direction at 15 deg. to 50 deg. The hanging-wall of the ore-body is ill-defined and largely conforms to the bedding of the shales. An additional control of secondary mineralisation is a transgressive system of minor faults and fractures. These strike north-east to north-north-east and are vertical or have a steep south-easterly dip. Members of this system are visible in the walls of the stope adjacent to the open-cut.

The ore minerals are cuprite and malachite with some tenorite and chrysocolla. The lode was highly ferruginous in outcrop but below the open-cut quartz and kaolin are the only important gangue minerals. The lode has been penetrated to a vertical depth of over 150 ft. with no significant change in the character of the ore. As the mine is situated in a topographical divide area, it may be expected that the zone of oxidation will extend a considerable distance below this level. The bulk of the ore is of rather low grade but pockets of higher grade oxide ore (containing up to 20 per cent. Cu) occur which enables the average grade to be maintained at 9 to 10 per cent.



Workings.—(See Fig. 2.) Surface workings consist of several prospecting pits and an open-cut which is 115 ft. long, 35 ft. wide and has a maximum depth of 42 ft. At a depth of 42 ft. a hanging-wall stope has been mined adjacent to the open-cut. The stope is 80 ft. long of average width 15 ft. and of maximum height 20 ft. A drive extends 15 ft. westerly at a height of 10 ft. above the floor of the stope. This drive passes out of he main orebody into low-grade carbonate ore. An inclined shaft has

Text Fig. 2b.

"Lady Annie," Paradise Valley looking east shows the open-cut and the collar of the inclined shaft from the base.

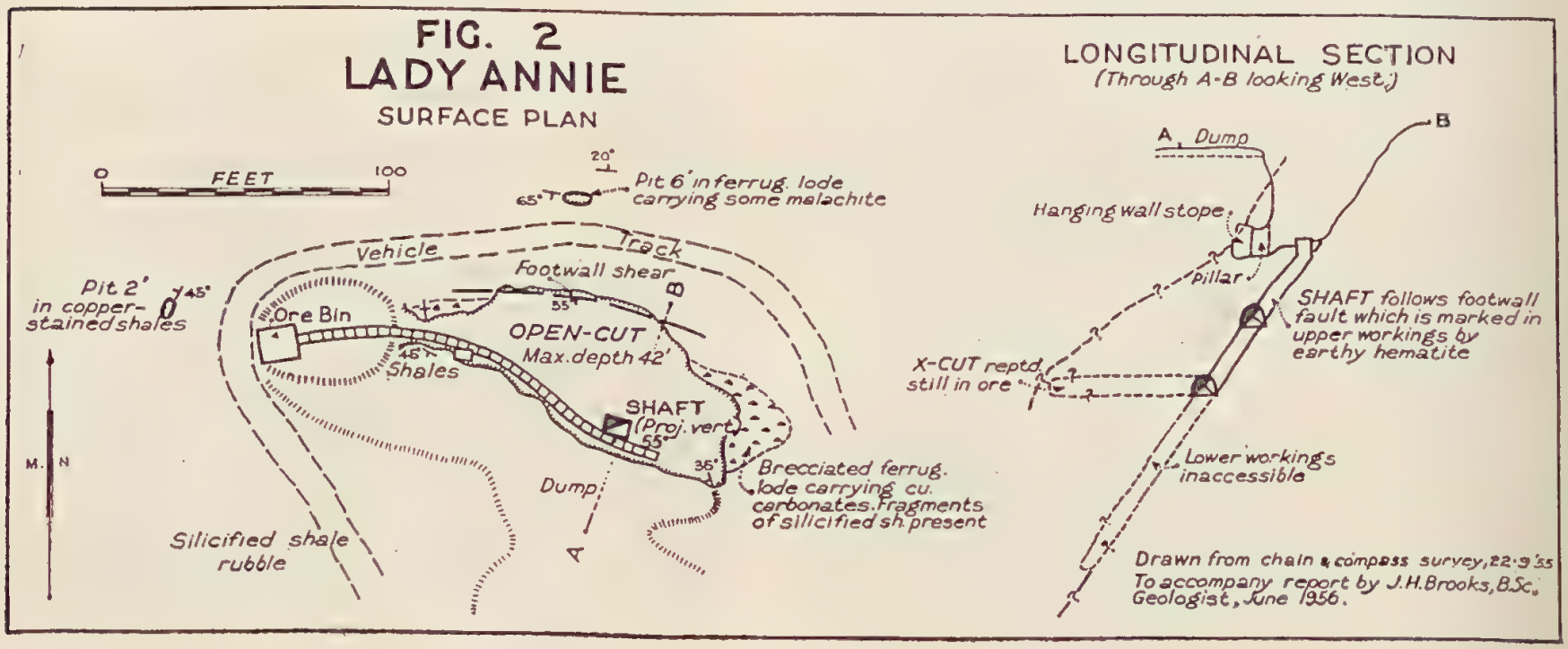
Text Fig. 2c.

"Lady Annie," Paradise Valley looking west shows the open-cut and the ore-bin in the middle distance.

been sunk from the floor of the open-cut. This is vertical for 7 ft. and then follows the foot-wall fault which dips southerly at 55 deg.

On the No. 1 level which is 35 ft. from the shaft collar, drives extend easterly for 51 ft. and westerly for 52 ft. These drives were being extended at the time of the May, 1956, inspection. The foot-wall fault zone is marked by ferruginous ore carrying low copper values. In the drives an attempt has been made to follow the higher grade ore which occurs adjacent to this foot-wall zone. Further development of this level by driving and crosscutting was intended by the operators.

On the No. 2 level which is 65 ft. from the shaft collar it is reported that drives extend 58 ft., easterly and westerly and a cross-cut extends 58 ft. southerly. These workings were inaccessible at the time of the May, 1956, inspection, but the shaft was accessible to this level at the time of the previous inspection. It is reported that the ore taken from the drives



and crosscut averaged 10.2 per cent Cu. An oblique drive at the No. 2 level for 25 ft. north-westerly passed into the foot-wall shales which contain disseminated malachite. From this drive and surface pitting there appears to be a considerable body of this low grade ore beyond the foot-wall of the higher grade lode. Although the grade of this ore is well below economic limits under present mining conditions, it would merit consideration if large-scale mining operations were contemplated. The inclined shaft is reported to have been deepened over 70 ft. below the No. 2 level. The ore averaged 8 per cent to 9 per cent. Cu and the intensity of mineralisation was maintained to the base.

Prospects.—From the few exposures available it would appear that the width of the ore-body increases below the outcrop. The maximum width of ore at the open-cut level is approximately 65 ft. compared with 42 ft. in the outcrop. At the No. 2 level the width is not known but exceeds 58 ft. Adopting an average lode width of 35 ft., the indicated ore reserves between the open-cut and the No. 2 level would be 16,000 tons of 9-10 per cent. Cu. Inferred ore reserves below the No. 2 level, assuming the depth of oxidation exceeds 200 ft. amount to 32,000 tons. At present there is an ore purchase quote of 65 tons per month from this mine and this scale of production seems out of keeping with the potentialities of the ore deposit.

Lady Jean.

This lease was formerly known as the "Harriet Doris." It is also held by G. H. Sanderson. Little mining has been carried out on the deposits within this lease since it was described by A. K. Denmead (1937). A trial parcel of 12 tons of selected ore was produced in 1954 from shallow workings. This yielded 2·9 tons of copper (23 per cent. Cu). Total production only amounts to 49 tons of ore for 12·6 tons of copper (26 per cent. Cu). Further small production of high-grade ore could be obtained.

Paramount.

This claim was formerly known as the "Last Out." Some prospecting of the cuprite-bearing ironstone lodes has been carried out recently and a trial parcel of 5·6 tons of ore assayed 10·2 per cent. Cu.

MOUNT OXIDE AREA.

Mount Oxide.

Lease Tenure.—This mine has been closed since 1944 but mining was resumed in 1955. The mine is at present held by H. J. McCullock under the lease "New Mount Oxide" M.L.4039. J. Vancea and party obtained a tribute for a period of 2 years from September, 1954. A sub-tribute has been obtained by a syndicate operating as the Tresnal Mining Company.

Access.—Previously all ore from Mount Oxide was trucked by road to the rail-head at Dobbyn and was treated largely at the Chillagoe smelter. The present operators have shown considerable enterprise in constructing an access road on a direct route to Mount Isa as suggested by Shepherd (1946). The distance by road to the Mount Isa smelter is 104 miles which comprises 28 miles along the bitumen-surfaced Barkly Highway, 35 miles by graded track to the first Gunpowder Creek crossing, and 41 miles of fair to rough vehicle track to the mine. For the last 25 miles the track traverses rugged hill country and a difficult crossing of Gunpowder Creek north of the "Mammoth" mine is included.

Previous Literature.—The geology of the deposit and the mine workings have been described in various published and unpublished reports. The most recent published report is that of S. R. L. Shepherd (1946), which included a Bibliography.

Production.—Total production previous to 1955 was 34,935 tons of ore of which 32,740 tons contained 8,417·6 tons copper (25·7 per cent.). 28,712 oz. silver are recorded from 19,753 tons of this ore.

PRODUCTION TABLE 1955.

	J. Vancea's party.			Tresnal Mining Company.		
	Tons Ore.	Tons Cu.	Per cent. Cu.	Tons Ore.	Tons Cu.	Per cent. Cu.
March	98·19	11·00	11·2	..	..	..
April	106·71	19·71	18·4	..	..	..
May	92·77	16·08	17·3	..	..	..
June	28·55	5·68	19·9	..	..	..
July	254·48	41·45	16·3	60·48	8·94	14·8
August	351·24	48·07	13·6	126·34	16·72	13·2
September	310·25	44·83	14·4	295·03	37·80	12·8
October	629·14	70·47	11·3	224·04	31·62	14·4
November	749·97	66·27	8·8	103·52	10·84	10·0
December	423·96	44·63	10·5	524·91	42·02	8·4
	3,045·26	368·19	12·1	1,334·32	147·94	11·1
Combined Total				4,379·6	516·13	11·8

Recent Mining Operation.—Production has come largely from stopes between the 208-ft. level and the 297-ft. level. Vancea's party has operated from the main adit (208-ft. level) and has worked the section between the No. 1 north winze and the No. 3 north winze. The Tresnal Mining Company has operated from the New Main shaft and the 177 ft. level adit and has worked the section from the No. 4 north winze to a point 30 ft. north of the No. 3 winze. The Mount Oxide United syndicate was formed early in 1956 to mine the section from the No. 3 north winze to a point 30 ft. to the north. It is reported that ore amounting to less than 100 tons has been taken from mine dumps. The operators have sought to keep the grade of ore produced at 10 per cent. Cu or higher so that considerably greater stoping widths have been possible compared with earlier mining operations.

From No. 1 north winze on the 208-ft. level a stope of approximate dimensions 60 ft. long, 15 ft. wide and 50 ft. high has been mined. Over 1,000 tons of ore has been produced from this stope. Stoping was extended 40 ft. south of No. 1 north winze where the mineralisation weakens and only small, lenticular pockets of ore remain in the graphitic shales.

From No. 2 north winze stoping has been extended north for approximately 50 ft. The maximum stope dimensions are 65 ft. long, 65 ft. high and 20 ft. wide. Over 2,000 tons of ore have been mined from this stope excluding over 1,000 tons of sub-economic grade ore despatched to Mount Isa or broken in the stope. The foot-wall of the lode is not well defined in this section and due to dilution the grade of ore dropped to an uneconomic level and stoping was discontinued.

Some stoping has been carried out above the 208-ft. level 15 ft. north of No. 3 winze. It is reported that 100 tons of 8 per cent. ore were obtained from this section. From a rise 20 ft. north of the No. 2 winze a sub-level was being driven south and some stoping from the drive was intended.

The section operated by the Tresnal Mining Company was not accessible at the time of the May, 1956, inspection. The stope was reported to extend above the 297-ft. level to within 30 ft. of the 208-ft. level and from the No. 4 north winze to 15 ft. from the No. 3 winze. The average width of stoping was 15 ft. The stope was being extended through to the No. 3 winze at time of inspection in ore reported to assay 12 per cent.-15 per cent. Cu. Distributed through the massive chalcocite is an appreciable amount of finely granular chalcopyrite.

Over 3,000 tons of ore have been produced from this stope. The grade of ore deteriorated towards the No. 4 winze but the limit of ore has not been defined in this direction. Probably less than 1,000 tons of ore remain in this section.

Prospects.—No exploratory or developmental work has been carried out by the present operators due to the limited period of tribute granted added to the fact that some months of this period were lost in making a trafficable road to the mine and in reconditioning parts of the workings.

In 1953 Mines Exploration Pty. Ltd. carried out a programme of diamond drilling to test the primary mineralisation at Mount Oxide. Only 2 of the 3 holes drilled reached the mineralised horizon and though these did not produce encouraging results, it is considered that the primary mineralisation has not been adequately tested. Early workings below the 297-ft. level are reported to have penetrated to the primary zone but there is no reliable data regarding size and grade and these workings are inaccessible.

Underground exploration along the strike of the lode has only been satisfactorily carried out on the 208-ft. level. Here ore averaging > 4 per cent. Cu continues for 400 ft. south of the high-grade ore-shoot and 200 ft. to the north*. The average width of this ore estimating from intersections in only three cross-cuts is 30 ft.

The amount of recoverable high-grade ore remaining in the mine is quite small. Future production will depend on the possibility of large scale mining operations which would enable the development of the lower grade ores.

Trioxide.

The leases are situated ¼ mile north-east of Mount Oxide adjacent to Cave Creek. The old workings on this lease are marked on a plan accompanying a report by Honman (1936). No production has come from the lease as earlier underground and surface prospecting did not reveal a deposit of economic grade. The change in economic conditions has given rise to the present interest in carrying out further underground prospecting.

Surface indications of copper mineralisation occur in a quartzite on the foot-wall of the graphitic slate horizon which is the host rock for the Mount Oxide deposit. The graphitic slates do not crop out but are represented on the surface by a soil-covered area largely devoid of tree-growth. The massive hematite occurring in the hanging-wall of the graphitic slates south of Cave Creek is virtually absent north of the creek. This horizon is represented by a siliceous lode which is ferruginous in part.

Surface workings consist of three costeans. An adit was driven in a northerly direction and cross-cuts were extended to the east and west. The cross-cut east traverses the graphitic slate horizon which is closely folded and contorted in part. The shales carry copper carbonate and sulphate along bedding planes but the grade appears too low to be of economic significance. A new adit bearing north 15 deg. east has been commenced nearly 100 yd. south-easterly from the old adit. At the time of inspection the adit had been advanced 30 ft. from the portal but had not reached the graphitic slate horizon. Some further

* From Mount Elliott Ltd. Assay Plan.

underground exploration is warranted but it is considered that the prospects of finding a significant quantity of ore are not very favourable.

Mount Gordon.

This lease which has also been known as "Oxide Creek" is situated 3·5 miles north-east of Mount Oxide. There has been no recent production but J. Vancea and party were examining the mine with a view to reopening it. Recorded production is 101 tons of ore containing 24·5 tons of copper (24·2 per cent.).

The significant copper mineralisation is confined to a breccia which occurs between graphitic shales on the east and arenaceous shales on the west. The major Mount Gordon fault which strikes north-north-east passes close to the mine. The breccia consists of fragments of arenaceous and argillaceous shale in an argillaceous matrix. The matrix has been partly replaced by chalcocite and some malachite also occurs. The main drive on the Adit level followed the contact between the breccia and the graphitic shale for 285 ft. and copper mineralisation in the breccia is variable but persistent over this length. The width of the breccia has only been explored in the adit where it is 5 ft. wide. High grade chalcocite ore occurs in places but systematic sampling would be necessary to determine grade of ore in the breccia.

A description and plan of the workings is given by C. S. Honman (1938). No mention is made of workings below the Adit level which were inaccessible. Warden's reports (1913-14) state that the winze from the Adit level was sunk 116 ft. A crosscut at 50 ft. showed a width of 17 ft. of chalcocite ore. Drives from the base of the winze extended north for 46 ft. and south for 34 ft. The north drive was in the graphitic shale horizon, but the south drive followed the mineralised breccia and in the face of the drive where only the hanging-wall was exposed, 3 ft. of high-grade ore (35 per cent. Cu) was reported. Early production of 24 per cent. ore was obtained from developmental work and gives encouragement for further testing of the breccia by sampling and underground development.

Suggestions for further exploration of the deposit are:—

(1) Crosscut the breccia horizon in several places to determine the width and the grade.

(2) Test the authenticity of favourable reports of workings below the Adit level.

Mammoth.

The lease is held by L. Pether, J. W. Pether and J. Lapanni. The "Mammoth" mine has been previously described (Shepherd, 1946a). This includes claims previously taken up as the "Kangaroo" and "Wallaroo." The mine is 85 miles by road from Mount Isa. Present access is via the Barkly Highway for 28 miles, thence 56 miles by the graded Mount Oxide track. The mine is less than one mile south-south-west of the Mount Oxide track. Recorded production for the mine is 732 tons of ore for a yield of 106·8 tons of copper (14·6 per cent. Cu). The most recent production was in 1953 when 143 tons of ore averaging 8·9 per cent. Cu was mined from open-cuts.

No work was in progress at the time of inspection and underground workings were inaccessible. Recent workings include shallow open-cuts north-north-east of the main open-cut. The lode here consists of a siliceous breccia with hematite and some malachite replacing the matrix. The ore exposed in the open-cuts was of rather low grade. From the available exposures there appears little justification for expecting any marked improvement in grade with depth. Low grade malachite-hematite ore is widely distributed along the mineralised strike faults which traverse the lease but the prospects of finding significant amounts of ore of economic grade are not considered favourable.

CALTON HILLS.

Mount Maggie.

A description of the geology and workings is contained in a report by S. R. L. Shepherd (1946a). The lease was previously known as the "Matlock." It has been worked by various parties, the last being R. M. Mezey's party in 1955.

The deposit is of relatively low grade and production has only taken place during the 1944-5 period and since 1953, when the ore could be treated at Mount Isa. Copper mineralisation is somewhat irregularly distributed through the lode but higher values occur towards the north-eastern side in association with a higher iron content in the siliceous gangue. Concentration of secondary copper minerals has also been influenced by fracture and joint planes. Assays of five samples taken across the lode over a width of 25 ft. (see Fig. 3) ranged from 2·45 per cent. Cu on the south-eastern side to 7·15 per cent. Cu on the north-eastern side [1]. The average of three samples over a width of 15 ft. on the north-eastern side was 5·4 per cent. Cu.

Production has continued to come from the open-cut but the grade has deteriorated and recent parcels of ore have only averaged 5·9 per cent. The total width of the lode could not be mined on an economic basis but by selective mining production could be continued from the present open-cut face. However, in view of the rather remote location appreciable quantities of ore would be dependent on the continuance of favourable conditions in the copper mining industry.

Total recorded production is 780 tons ore containing 61·8 tons of copper (7·95 per cent. Cu). Production in 1955 amounted to 87·8 tons ore containing 5·2 tons copper (5·9 per cent. Cu).

[1] Sampled by J. H. Brooks and assayed by the Government Assayer, Cloncurry.

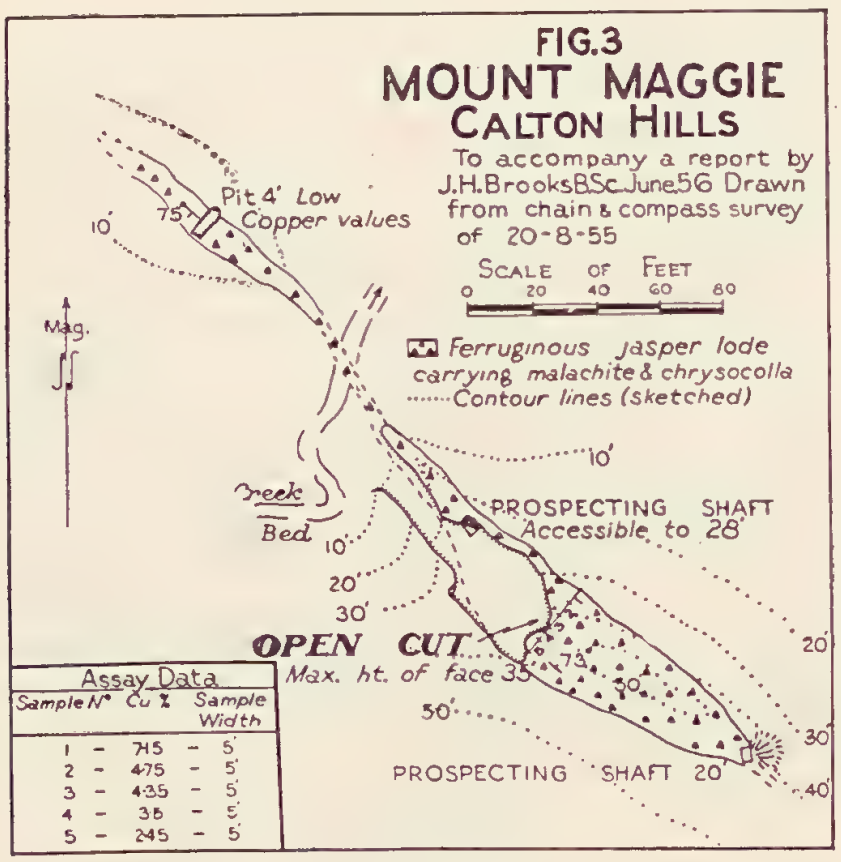


FIG.3
MOUNT MAGGIE
CALTON HILLS
To accompany a report by J.H.Brooks B.Sc. June 56 Drawn from chain & compass survey of 20-8-55
SCALE OF FEET
0 20 40 60 80
Pit 4' Low Copper values
Ferruginous jasper lode carrying malachite & chrysocolla
Contour lines (sketched)
Mag.
Creek Bed
PROSPECTING SHAFT Accessible to 28'
OPEN CUT
Max. ht. of face 35'
PROSPECTING SHAFT 20'
Assay Data
Sample N° Cu % Sample Width
1 - 7·5 - 5'
2 - 4·75 - 5'
3 - 4·35 - 5'
4 - 3·5 - 5'
5 - 2·45 - 5'

MacLeod Hill.

MacLeod Hill is at present held as a Mineral Claim by N. Shaw and was last worked in 1954. It has also been known at Mount McLeod. Access from Mount Isa is by the Barkly Highway for 55 miles, thence 27 miles by fair bush track to the lease. Total recorded production is 241 tons of ore containing 33·5 tons of copper (13·9 per cent. Cu).

The Rock sucession in the area consists of sandstone with inter-bedded argillaceous and calcareous shales striking north 10 deg. west. No intrusive rocks are known in the area. The deposit is situated close to the divide between Inca Creek (inland drainage system) and Gunpowder Creek (coastal drainage system) and the rocks are deeply weathered. The higher residual hills have ferruginous capping rocks.

Copper mineralisation occurs in a narrow, well-defined, strike-fault zone which dips 70 deg. to 78 deg. west. On the hanging-wall a barren, massive ferruginous lode occurs and on the foot-wall phyllitic strata occur which probably represent locally sheared, calcareous shales. Copper mineralisation is exposed discontinuously over a strike length of 225 ft. The main section of mineralisation occurs over a length of 100 ft. and has an average width of 1 ft. 3 in. Malachite and chrysocolla are present as fine veins and cavity fillings in a quartz gangue. Varying amounts of iron oxides are also present.

The main workings consist of a shaft 16 ft. deep connecting with an adit 50 ft. long. These workings were partly fallen in. A winze near the northern end of the adit is partly filled and inaccessible. A small pit 85 ft. south of the shaft exposes the continuation of the copper mineralisation which has narrowed in width to 9 in. One hundred and twenty-five ft. north-north-west of the shaft a prospecting shaft has been sunk to a depth of 22 ft. A trench 16 ft. long and 4 ft. deep adjacent to the shaft shows the fault carrying stains of malachite and chrysocolla.

As the main workings are in poor condition futher underground exploration could probably best be carried out by shaft sinking to intersect the lode below these workings. On present indications the prospects of further production are not good.

Mount Kelly and Mount Clarke.

These leases were being worked by M. Kuesera and party under tribute from J. J. Spreadborough and party. Access from Mount Isa is by the Barkly Highway for 55 miles, thence 31 miles by fair to rough bush track. Mount Clarke is ¾ mile north-north-west of Mount Kelly.

Copper carbonates occur along joint and cleavage planes in a horizon of slates. At Mount Kelly workings consist of an adit 43 ft. long, an inclined shaft which has water at a depth of 15 ft. and small, shallow open-cuts. The slates strike north 55 deg. west and dip 38 deg. north-east but minor folding and brecciation of the slate occurs. Some production has come by selective mining and hand-picking. A considerable amount of low grade ore remains but the grade is barely high enough to offset the remoteness of location of the deposit.

At Mount Clarke copper mineralisation occurs in an anticlinal structure in slates. Minor buckling and brecciation of the strata has taken place. The strike is north 20 deg. west and dips range up to 60 deg. both easterly and westerly. The anticlinal structure pitches to the south at a low angle. The workings consist of several pits the deepest being 8 ft. Some further ore may be won near the surface by hand-picking but there is little prospect of significant production.

Production from Mount Kelly for 1955 was 351 tons of ore containing 26.3 tons copper (7·5 per cent. Cu). Prior to 1955 recorded production only amounted to 23 tons of ore containing 2·3 tons copper (10·0 per cent. Cu).

KAJABBI ROAD AREA.

Yamamiller.

The lease is held by C. Watson and C. Cummins. It is situated 6 miles south-east of Mount Remarkable and access to the railway at Kajabbi is by vehicle track for 30 miles.

The deposit was one of the early discoveries of copper in the Cloncurry Mineral Field and was originally taken up as the "Yamamilla" Freehold (Ball, 1908). However, the grade was too low to allow appreciable production till recent years. Since 1948 production on a small scale has been intermittent and totals only 301 tons of ore containing 29·9 tons of copper (9·7 per cent. Cu). The lease was under option to Red Terror Gold Mines N.L. during part of 1955 but although the mine was dewatered and some developmental work carried out, no production took place.

The deposit is situated near the junction of a succession of quartzite with calc-silicate rocks. The mineralised lode bifurcates towards the north and the main development has been along the western branch towards the junction of the two lodes. This branch strikes north 22 deg. west and dips 80 deg. east. It consists of a quartz breccia with a central mineralised section flanked by almost barren hanging-wall and foot-wall sections. The central mineralised section ranges from 1 ft. to 4 ft. in width and averages 2 ft. Malachite, chrysocolla and some chalcocite occur in the matrix of the breccia and there is also a surface development of limonitic jasper. The eastern branch lode strikes north 3 deg. east and dips 65 deg. easterly. On surface indications copper mineralisation is weak. South of the main workings small patches of cuprite occur in the lode outcrop which consists of limonitic jasper.

An adit has been driven 73 ft. south along the lode. (See Fig. 4). The floor of the adit is 8 ft. above creek level. At 55 ft. along the adit an inclined winze has been sunk. These lower workings were inaccessible at the time of inspection due to the influx of water but it is reported that the winze is staged at a depth of 35 ft. and drives have been put in 14 ft. to the north and 11 ft. to the south. The lode is reported to be 2 ft. wide and the grade approximately 10 per cent. Cu. A shaft collared 10 ft. east of the adit is said to be 60 ft. deep but this was inaccessible. A second prospecting shaft was sunk on the eastern branch lode but water was present at a depth of 20 ft.

Although the deposit has not been fully developed the narrowness of the significant mineralisation, the mediocre grade and the heavy influxes of water below the adit level militate against further mining of the deposit.

Referee.

The lease is held by W. J. Fisher. In 1955 the western portion was being worked under tribute by U. Angelli and party, and in 1956 the eastern portion was being worked by Dixon's party. It was previously known as the "Ruth" (Ball, 1908).

The lease is situated 3 miles south of Mount Remarkable. The access by road from Mount Isa consists of 12 miles on the new Cloncurry road thence 38 miles by the fair to rough track which connects Mount Isa with Kajabbi. The deposit is situated ¼ mile east of the Kajabbi track. Recorded production to 1954 consists of 1,253 tons of ore containing 276·1 tons of copper (22 per cent. Cu).

The lode strikes north 84 deg. east and dips south at 65 deg. to 85 deg. The country rock is a medium-grained pink granite. In Bullock Head Creek a basic intrusive crops out which marks the western end of the Referee lode. The relation of the lode to regional faulting is shown on the sketch of the mine area. Main mineralisation is confined to the Eastern and Western ore-shoots which are approximately 500 ft. apart. The lode in the productive sections ranges up to 25 ft. in width although significant copper mineralisation is usually confined to a width of not more than 5 ft.

Western Ore-Shoot (see Fig. 5).—The outcrop is somewhat leached and copper mineralisation is confined largely to carbonates which occur in limonitic gossan and quartz gangue. A zone of secondary enrichment occurs from a depth of 35 ft. to 60 ft. and most of the ore mined appears to have come from stopes above the 50-ft. level and between the 50-ft. and 60-ft. levels. At the 50-ft. level the ore attained a maximum width of 16 ft. and was stoped over a length of 90 ft. judging on exposures in accessible workings. The ore is reported to have consisted largely of copper glance and black oxide. The face of the west drive on the 50-ft. level and the east drive on the 60-ft. level show quartz-chlorite lode material containing copper mineralisation of sub-economic grade. Further driving to the west is not warranted but further prospecting from the eastern end of the workings could result in the exposing of some additional ore. The mineralisation below the 60-ft. level consists very largely of primary sulphides. The ratio of pyrite to chalcopyrite varies from place to place but is usually high. Covellite also occurs but is usually present only as coatings on the chalcopyrite. The present operators are sinking an inclined winze from the 60-ft. level and intend to drive to connect with the winze from the 60-ft. level opposite the Main Shaft A steady influx of water occurs in the lower workings which forms a handicap to further exploration at depth. In addition it is unlikely that the overall grade of the primary sulphide will allow economic development. During 1955, 252 tons of ore were produced from this section containing 10·4 tons of copper (4·1 per cent. Cu). The grade of much of this ore was well below the economic limit and mining was discontinued early in 1956.

One hundred and fifty feet east of the most easterly shaft shown on the surface plan is another prospecting shaft which was collared on the hanging-wall of the lode. It is vertical for 40 ft. and then follows the dip of the lode to the south. Water is present at a depth of 50 ft. Some trenching has been carried out between this shaft and the main workings but little gossan is showing and the indications of mineralisation are not encouraging.

Eastern Ore-Shoot.—Surface workings consist of an open-cut 66 ft. long, 20 ft. wide and 8 ft. deep. The lode attained a maximum width of 12 ft. and was similar in outcrop to the Western ore-shoot. As the mine was inaccessible below the 35-ft. level, information on workings below this level has been obtained from the lessee. The Main Shaft is situated 20 ft. east of the open-cut and has a depth of approximately 90 ft. A second shaft 50 ft. east of the Main Shaft is reported to be 68 ft. deep and a shaft from the floor of the open-cut extends to a depth of 40 ft. Levels were driven at depths of 35 ft., 56 ft., and 68 ft. Drives east from the Main Shaft from the 56-ft. level and the 68-ft. level connected with the east shaft. Drives west from the Main Shaft at the 56-ft. level and the 68-ft. level are reported to have extended 60 ft. and 120 ft. respectively.

FIG. 4
YAMAMILLER
PLAN – ADIT LEVEL

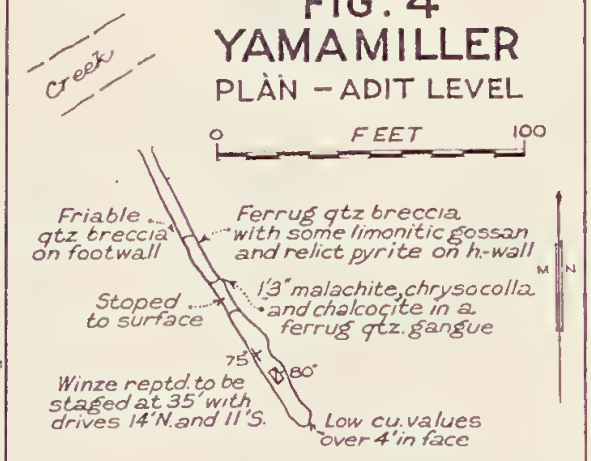
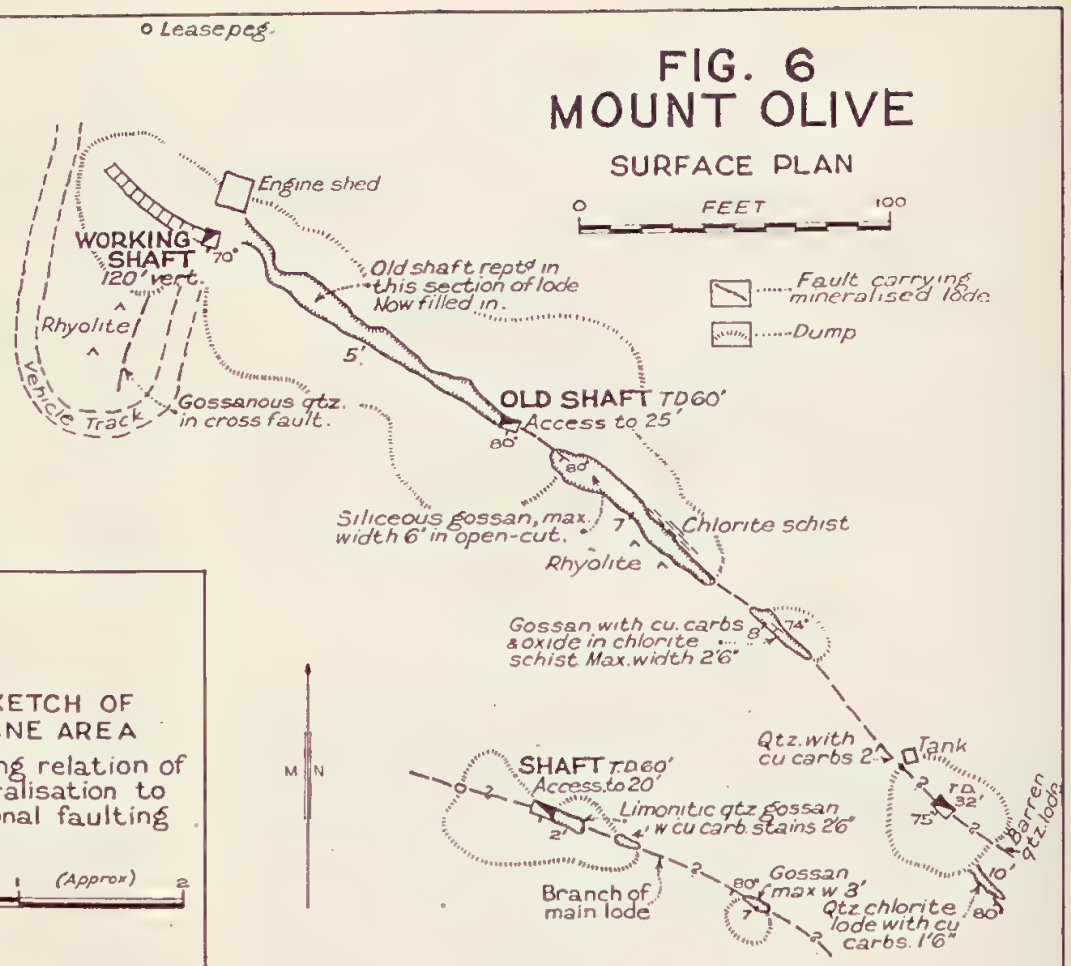

Creek
0 FEET 100
Friable qtz breccia on footwall
Ferrug qtz breccia with some limonitic gossan and relict pyrite on h-wall
1/3" malachite, chrysocolla and chalcocite in a ferrug qtz. gangue
Stoped to surface
75°
80°
Winze reptd to be staged at 35' with drives 14'N. and 11'S.
Low cu. values over 4' in face
M
N

FIG. 6
MOUNT OLIVE
SURFACE PLAN



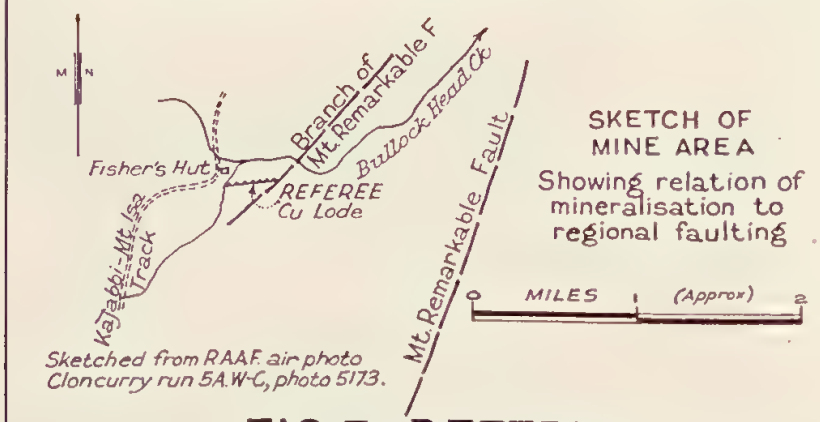
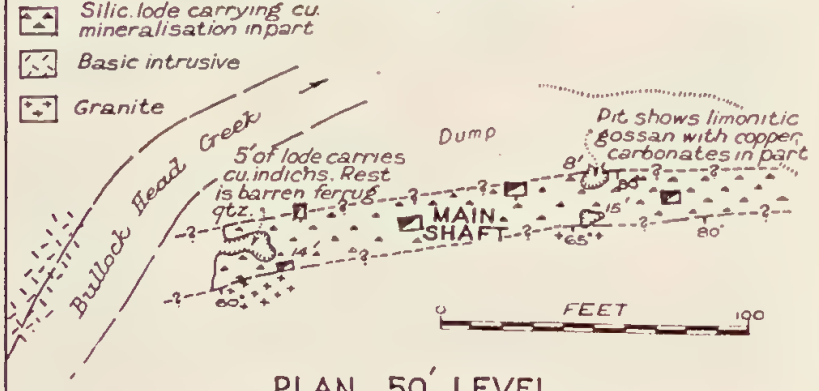


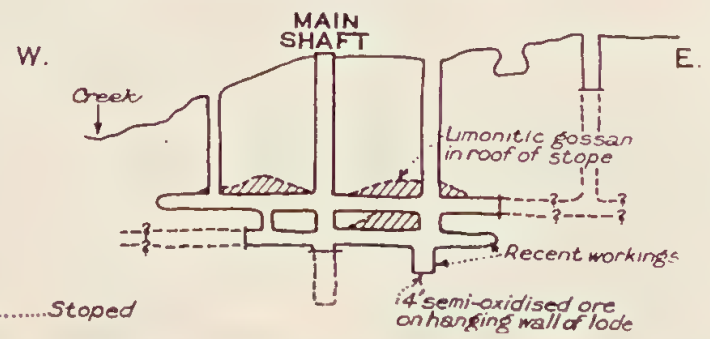
FIG. 5 REFEREE
SURFACE PLAN : WESTERN SECTION OF WKGS



PLAN 50' LEVEL

PLAN 60' LEVEL

LONGITUDINAL SECTION



Drawn from chain and compass surveys

LONGITUDINAL SECTION

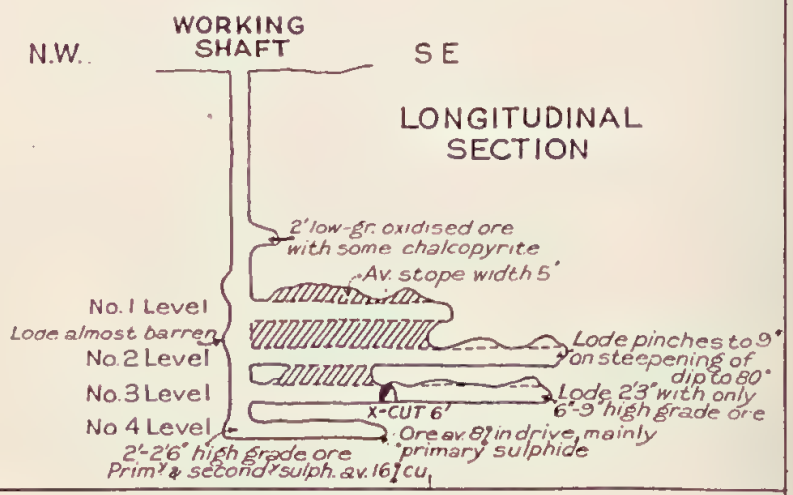
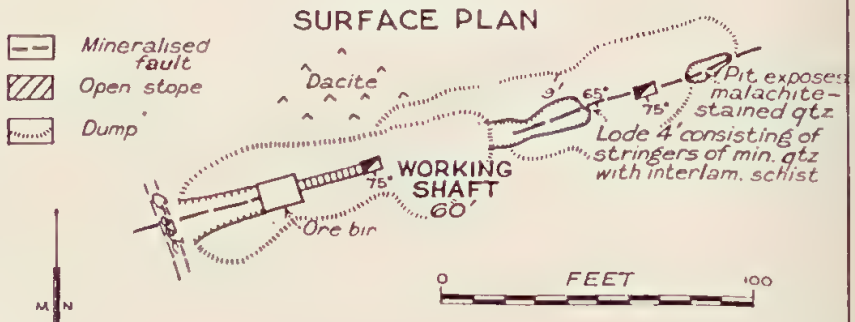
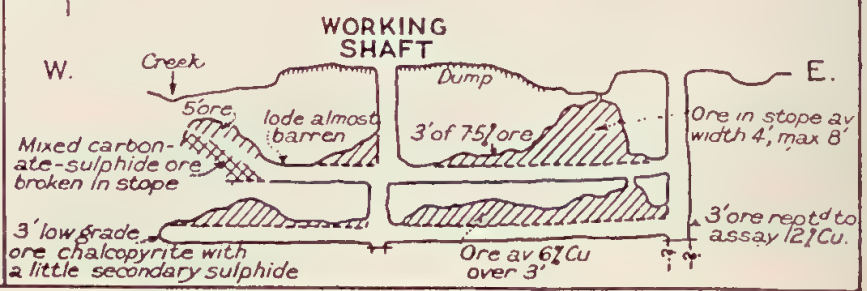

N.W.
WORKING SHAFT
S E
2' low-gr. oxidised ore with some chalcopyrite
Av. stope width 5'
No. 1 Level
Lode almost barren
No. 2 Level
No. 3 Level
No 4 Level
Lode pinches to 9" on steepening of dip to 80°
Lode 2'3" with only 6"-9" high grade ore
X-CUT 6'
Ore av. 8' in drive, mainly primary sulphide
2'-2'6" high grade ore
Prim'y & second'y sulph. av. 16% cu.

FIG. 7
LILLIMAY
SURFACE PLAN



LONGITUDINAL SECTION


WORKING SHAFT
W.
E.
Creek
Dump
5' ore
lode almost barren
3' of 7.5% ore
Ore in stope av width 4', max 8'
Mixed carbonate-sulphide ore broken in stope
3' low grade ore chalcopyrite with a little secondary sulphide
Ore av 6% Cu over 3'
3' ore reptd to assay 12% Cu.

To accompany report by J.H. Brooks, B.Sc., Geologist. June 1956.

On the 35-ft. level overhand and some underhand stoping has been carried out for a distance of 22 ft. to the west. In this section the lode is 8 ft. wide and consists of limonitic gossan with malachite, chrysocolla, tile ore and some chalcocite. An intermediate drive above this level connects the stope with the shaft from the base of the open-cut. The east drive extends for 23 ft. and a little overhand stoping has been carried out. The lode in the drive is 4 ft. in width.

Recent work has taken place mainly on the 56-ft. level. This level was inaccessible due to the influx of water which necessitates daily dewatering of the mine. Much of the early production came from this level and the grade exceeded 30 per cent. Cu. The ore consists of chalcocite and tenorite. Towards the base of the shaft the lode is reported to consist of a central section with pyrite and some chalcopyrite in quartz flanked by sections containing chalcopyrite in quartz with secondary sulphides and oxide of copper.

Not much ore has been produced since this section of the "Referee" was reopened early in 1956 and it is not known how much recoverable ore remains in the lower workings.

Mount Olive.

The lease is held by A. Vohland, W. Lilliman and J. May and the mine is being operated by A. Vohland. It is situated one mile east of the Mount Isa-Kajabbi track and less than one mile north-east of the "Manxman" mine. Access from Mount Isa is via the new Cloncurry road for 12 miles, thence 27 miles by fair to rough vehicle track to the lease.

Production.—Most of the recorded production from this lease has been since 1953. Total production to 1954 was 478 tons of ore containing 53·9 tons of copper (11·3 per cent. Cu). Production in 1955 amounted to 587 tons of ore which yeilded 69·3 tons of copper (11·9 per cent. Cu). This is one of the few copper deposits in the Field where a new ore-shoot of significant size has been discovered as a result of recent underground exploration. The full extent of the ore-shoot has not been determined but already over 700 tons averaging 12 per cent. copper have been mined.

Geology.—The deposit occurs in a rhyolite porphyry succession. In the vicinity of the mineralised fault the rhyolite is sheared and altered and the minerals talc, sericite, kaolin, and chlorite are developed. The outcrop of the lode which can be traced discontinuously over a distance of 250 yd., is arcuate in outline. The strike ranges from north 40 deg. west in the south-eastern section to north 70 deg. west in the north-western section, and the dip ranges from 70 deg. south-westerly to almost vertical. The outcrop is leached and usually consists of a limonite-quartz gossan containing small amounts of malachite and various other secondary copper minerals. As the main lode is traced from the south-east several branch lodes diverge towards the west. These lodes usually pinch out within a short distance of the main lode but one persists for about 250 ft. and has been productive of some copper ore. Near the Working Shaft a narrow, gossanous quartz outcrop marks a cross-fault striking north 15 deg. east. Although the main dump obscures much of the outcrop in this area, the fault appears to terminate the mineralised lode and the concentration of copper ore on the south-eastern side may be attributable to this cross-feature.

Workings (see Fig. 6).—Apart from some ore which was won from shallow open-cuts along the line of lode, earlier production came from an ore-shoot situated near the Old Shaft and extending towards the Working Shaft. It is reported that the ore extended from a depth of 20 ft. to 40 ft. and below this depth barren ferruginous lode material was encountered and work was abandoned when no further ore was encountered to a depth of 80 ft. The Working Shaft was collared roughly 12 ft. below the level of the Old Shaft. At a depth of 80 ft. a new shoot of semi-oxidised ore was located south-east of the shaft. The ore consists of chalcopyrite with subordinate pyrite in a gangue of quartz, chlorite and talc. The primary sulphide which occurs interstitial to coarsely granular quartz is enriched to varying degrees by covellite, chalcocite and tenorite. Pockets of relatively unaltered primary sulphide ore may occur adjacent to extensively oxidised portions. In places black oxide and secondary sulphides have been deposited in kaolinised rhyolite near the hanging-wall of the main siliceous lode. Usually the total width of siliceous lode does not carry copper ore and the average width of mineralised lode is between 3 ft. and 4 ft. The foot-wall is well defined and dips south-west at 70 deg.-80 deg. The hanging-wall has a rolling outline so that the lode tends to bulge and pinch. Stringers of mineralised quartz frequently diverge from the main lode into the hanging-wall country rocks.

The Working Shaft now has a vertical depth of 120 ft. and ore has continued to this depth. Near the base of the shaft high-grade ore occurs over a width of 2 ft. to 2 ft. 6 in. and ore from this section averaged 16 per cent. Cu. The ore-shoot has been developed by a series of drives to the south-east at depths of 82 ft., 96 ft., 108 ft., and 120 ft.

On the 96-ft. level (No. 2 level) ore has been stoped above over a length of 60 ft., a width of 5 ft. and a maximum height of 20 ft. The drive was continued to a total length of 101 ft. In the face of the drive the lode has narrowed to 9 in. on a steepening of the dip of the mineralised shear. For the last 40 ft. in the drive the lode ranges from 2 ft. to 5 ft. in width but the width of ore-grade material is usually less than 1 ft.

On the 108-ft. level (No. 3 level) ore has been stoped to the No. 2 level over a length of 30 ft. and a width of 4 ft.-5 ft. In the face of the drive which was extended to a length of 97 ft. the lode has narrowed to 2 ft. 3 in. with high-grade ore confined to 6 in. on the foot-wall side. The drive at the 120-ft. level was 50 ft. long and being extended at the time of inspection. The lode averages 4 ft. 6 in. in width

but usually less than half of this width carries ore of economic grade. Parcels of ore from the drive are reported to average 8 per cent. Cu.

Mine development up to date suggests that the ore-shoot has a steep westerly pitch. In view of this and the fact that high-grade ore was encountered towards the base of the shaft, further exploration of the deposit by deepening the shaft and driving north-westerly may expose further significant amounts of ore.

The branch lode (see Fig. 6) has been developed by several pits and a shaft which is reported to have reached a depth of 60 ft. A high-grade shoot of secondary ore 1 ft. wide was developed from the shaft. Over 100 tons of chalcocite-cuprite ore are reported to have been produced.

Lillimay.

The lease is held by T. R. McMillan and party (Lillimay Mining Syndicate). Access from Mount Isa is via the new Cloncurry road for 12 miles thence 28 miles by a fair to rough track to the lease. It is one mile east of the Mount Isa-Kajabbi track and one mile north-north-west of the "Mount Olive" mine.

Production.—There is no record of early production from this deposit. In the 1953-54 period 758 tons of ore were mined containing 50·9 tons of copper (7 per cent. Cu). Production was discontinued in 1954 but recommenced in 1956. The ore is of marginal grade and favourable conditions in the copper industry are necessary to give encouragement for further mining.

Geology.—The deposit occurs in dacite and rhyolite with some basic intrusives. Porphyritic granite occurs approximately one mile west. The mineralised fault which can be traced semi-continuously over a quarter of a mile ranges in strike from north 78 deg. east to north 87 deg. east, and is transgressive of the meridional trend of the country rocks. The dip of the fault is 65 deg.-75 deg. southerly. The limonite-quartz gossan averages 3ft. in width and has a maximum width of 5 ft. The outcrop often consists of stringers of quartz and gossan separated by bands of talc-chlorite schist and biotite schist. Some malachite, azurite and a little tenorite is present.

Workings (See Fig. 7).—Surface workings consist of a small open-cut and several prospecting pits. The Working Shaft has a depth of 60 ft. It is vertical for 11 ft. and then inclined 75 deg. to the south. A second shaft similarly inclined and 90 ft. east of the Working Shaft is at least 60 ft. deep. Levels have been driven at vertical depths of 38 ft. and 57 ft. and the shafts are connected by driving at both levels. The total length of driving on each level is approximately 160 ft. At the time of inspection overhand stoping was in progress in the No. 1 level west drive and the operators intend to continue driving on this level. Assays of samples from the eastern shaft give encouragement for further driving to the east but the lode is not expected to persist far in this direction. Copper mineralisation is rather sporadically distributed but most of the ore has been won from ore-shoots extending below the open-cut and below the ore-bin area. On the No. 1 level the ore consists of chalcopyrite in quartz with appreciable amounts of malachite, azurite, tenorite, and covellite. On the No. 2 level only a small amount of secondary minerals occurs with the chalcopyrite.

Lillimay Extended.—This includes the western continuation of the "Lillimay" line of lode. There are two prospecting shafts. The deeper shaft underlies to the south at 70 deg. and has water at a depth of 25 ft. Dump material consists of low-grade chalcopyrite in quartz with coatings of covellite. The width of lode is 4 ft. 6 in. at the shaft. The second underlie shaft is nearly 100 ft. to the west and the water level is 20 ft. below the surface. The lode is 3 ft. wide but the grade would appear to be too low to allow economic development. Other workings consist of a pit 10 ft. west of the second shaft and this exposes low copper values over a width of 3 ft.

Manxman.

The lease is held by A. Vohland, J. L. Lilliman, and J. May. The mine has been previously described (Shepherd, 1946a). Little work has been done since 1946 but after clearing out work production had recommenced at the time of inspection (May, 1956). Total recorded production to 1955 only amounted to 262 tons of ore for a yield of 32·3 tons of copper (12·3 per cent. Cu).

The present operators have deepened the No. 1 (West) Shaft to 82 ft. From the haft levels have been driven east at depths 70 ft. and 82 ft. for distances of 33 ft. and 26 ft., respectively. On the 70-ft. level some oxidised ore was obtained but in the eastern face of the drive the lode consisted of 3 ft. 6 in. of weakly mineralised quartz. On the 82 ft. level only 1 ft. 6 in. of ore was exposed in the east face of the shaft but the lode increased in width in the drive to 3 ft. 6 in. in the working face. The ore consisted of chalcopyrite with a considerable amount of tenorite and covellite. A parcel of ore in the drive is reported to have assayed 14 per cent. Cu. Further driving is recommended as ferruginous gossan persists in the lode outcrop for over 380 ft. east of the No. 1 Shaft. A short drive extends west of the No. 1 Shaft at the 75-ft. level but the lode narrows to 1 ft. 6 in. The weakening of mineralisation can be attributed to the change in strike of the lode.

One hundred and ten feet east of the No. 1 Shaft a prospecting shaft has been sunk to a depth of approximately 30 ft. It is reported that the mineralised lode is 1 ft. wide in the base.

ARGYLLA AREA.

Blockade (Argylla) Group.

The adjacent "Blockade," "North Blockade," and "South Blockade" leases are held by J. and W. Garland. In recent years the operation of the "Blockade" mine has been carried out by the lessees, the Mining Producing Development Syndicate and various tribute parties. The line of lode was previously held as the "Argylla" Freehold (Ball 1908).

Access from Mount Isa is via the new Cloncurry road for 27 miles, thence 7 miles northerly by fair to rough track to the leases. The mine is adjacent to the Overland Telegraph line and is on the disused coach route from Cloncurry to Camooweal.

Total recorded production to 1954 for the three leases amounts to 2,438 tons of ore of which 2,142 tons contained 207·6 tons of copper (9·7 per cent. Cu). The deposit was one of the earliest to be worked in the Field and probably much of the early production is not recorded. Production in 1955 amounted to 690 tons of ore containing 50·3 tons of copper (7·3 per cent. Cu).

Geology.—The copper mineralisation is associated with a massive siliceous lode which crops out prominently over a length of half a mile and has an average width of 60 ft. The outcrop rises nearly 100 ft. above the general surface level. The strike is north 35 deg. west and the dip 65 deg.-75 deg. to the south-west. The relation of the lode to the regional fault pattern is illustrated in the area map (Fig. 8). Two step faults which strike north 60 deg. east and north 53 deg. east displace the lode and have some control on the distribution of secondary copper mineralisation. Usually the lode outcrop is not a single body of quartz but consists of two or more parallel ferruginous quartz lodes with interlaminated talc-sericite schists and biotite schist which have been formed by dislocation metamorphism (Joplin, 1955) and hydrothermal alteration. Away from the mineralised lode the country rocks consist of rhyolite porphyry with basic intrusives. The basic dykes strike principally north-north-east and north-west.

Secondary copper mineralisation is largely confined to small ore-shoots on or near the hanging-wall side of the massive siliceous lode. The ore-shoots are usually less than 100 ft. long and 6 ft. wide. The outcrop is generally leached and exhibits only carbonate stains. The main concentration of secondary minerals is between 10 ft. and 100 ft. below the surface. Normally the ore-shoots are conformable with the strike of the massive siliceous lode but particularly in the "North Blockade" section the mineralised quartz veins strike obliquely towards the massive siliceous lode in the vicinity of north 20 deg. west and terminate against it.

The principal copper minerals are malachite and cuprite with a lesser amount of chalcocite and azurite. A high-grade shoot of cuprite ore is reported to have been exploited in the early days of mining from the southern section of the lode (Fig. 8, point 4) and this averaged over 20 per cent. Cu. However, in general the ore-shoots are much lower in grade and would average less than 10 per cent. Cu. The primary copper mineral which is known only from drill cores, is chalcopyrite and this was found to occur both in the quartz veins and the interlaminated schists. Nine diamond drill holes ranging in depth from 150 ft. to 926 ft. were put down but results were disappointing (Honman, 1938b). The best intersection was 14 ft. of 4 per cent. Cu ore at a vertical depth of 150 ft.

Description of Working.

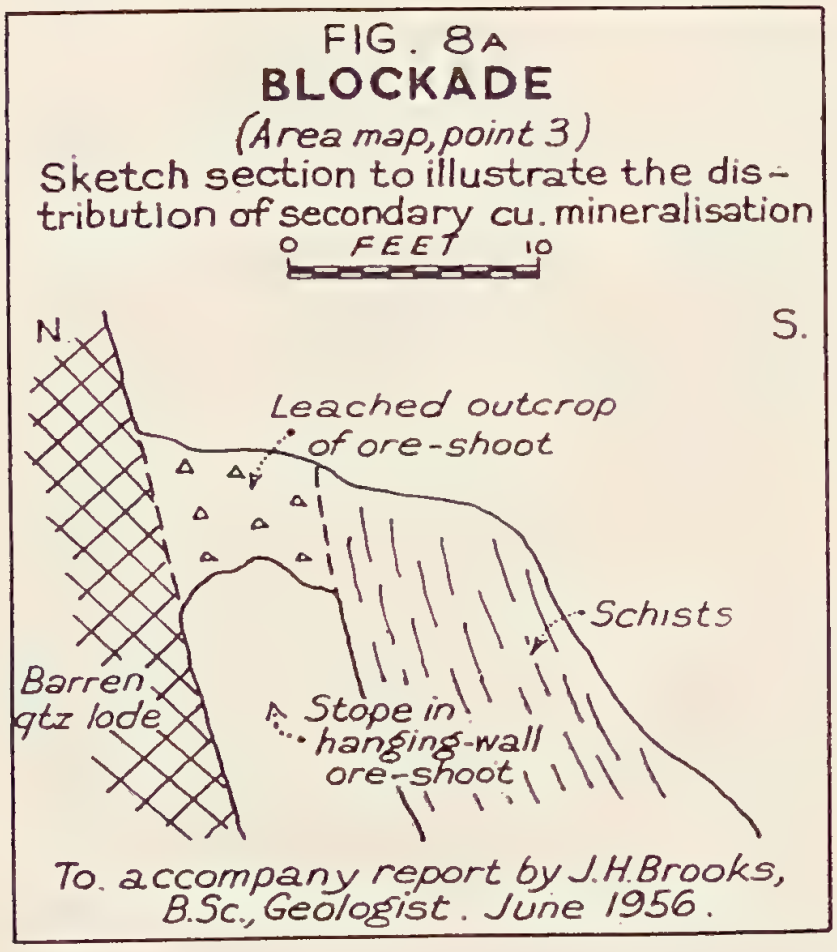
North Blockade (Fig. 8, point 1).—A number of mineralised quartz veins carrying malachite have been developed in this section. A prospecting shaft was sunk 35 ft. to explore a series of four roughly parallel veins which have been worked in the adjacent open-cut (Fig. 9). These are usually only 1 ft. to 2 ft. in width but a vein 4 ft. wide has been worked in the open-cut. The mineralised veins are interlaminated with talc-actinolite-sericite schists, chlorite-biotite schists and barren quartz veins. Another mineralised vein 2 ft. 6 in. wide has been tested by a small open-cut further to the north-west but the mineralisation weakens in this section and trenching still further to the north-west exposes only malachite-stained lode material. One hundred and fifty-five tons of ore containing 14·1 tons of copper (9·1 per cent. Cu) were produced from the "North Blockade" in 1955 but mining was discontinued in 1956.

Blockade (Fig. 8, point 2).—During 1953 a series of ore-shoots was being open-cut near the north-western end of the lease. These ore-shoots commence on the south-east of a fracture plane striking north 60 deg. east and diverge as they are traced south-east. At least four ore-shoots can be distinguished and these range in width up to a maximum of 6 ft. and fall off in grade from the hanging-wall ore-shoot towards the foot-wall. Underground workings (Fig. 10) consist of (1) a crosscut adit 136 ft. long which penetrates to the foot-wall schists; (2) a foot-wall drive extending approximately 50 ft. south-easterly from the adit; and (3) a winze to a depth of 48 ft. below the adit level. A crosscut southerly (inaccessible), and a drive 48 ft. south-easterly extend from the base of the winze. The drive from the winze would be approximately 130 ft. below the top of the outcrop and is the deepest accessible part of the workings. Three narrow ore-shoots are exposed in the adit and the mineralisation is largely controlled by a complex system of fractures. The mineralised quartz is interlaminated with copper-stained biotite and talc-sericite schist and with barren quartz and ferruginous quartz veins. An old shaft to the south-east of these workings is inaccessible.

About 150 ft. south-east of the adit another ore-shoot occurs on the hanging-wall of the lode. Workings consist of a small open-cut with an adit extending 35 ft. north-westerly along the lode. There is a small underhand stope below the adit to a depth of 30 ft. A crosscut extends 80 ft. northerly from the adit.

Only low-grade bands of carbonate ore are exposed in the crosscut. The hanging-wall ore-shoot is 2 ft. wide and low grade near the surface, but widens to a maximum of 6 ft. of fair grade ore with some rich pockets of radiating, crystalline malachite 25 ft. below the surface. This ore-shoot is terminated to the south-east by a step-fault striking north 60 deg. east and dipping 70 deg. south-east. Some rather low-grade carbonate mineralisation occurs along this fault in the vicinity of the massive siliceous lode.

On the south-eastern side of this step fault (see Fig. 8, point 3) another ore-shoot on the hanging-wall of the lode has been developed. A shaft has been sunk 28 ft. and an open-cut extends to the south-east with some stoping at the south-eastern end of the ore-shoot. The ore-shoot is less than 50 ft. long and is 6 ft. wide.



South Blockade (Fig. 8, point 4).—The main workings consist of two shafts (inaccessible) which early company reports state to have reached 100 ft. Some driving at the 100 ft. level is also reported. Between the shafts there is an open-cut 40 ft. long and 23 ft. deep. In the base of the open-cut limonitic gossan with lenses of chalcocite, malachite and tile ore occurs over a maximum width of 9 ft. The ore-shoot strikes north 20 deg. west and dips 75 deg. southerly. A new shaft has been sunk from the base of the open-cut for a depth of 60 ft. on an underlie of 75 deg. 80 deg. southerly. A drive was extended south-easterly a distance of 20 ft. from a depth of 57 ft. in the shaft. This drive encountered old workings and was discontinued. The ore in the drive consists of malachite and chalcocite in quartz and some limonitic gossan over a width of 8 ft. Shaft sinking was in progress with the intention of penetrating below old workings and establishing a new level. Some chalcopyrite occurs in the ore near the base of the shaft but the zone of secondary enrichment is expected to extend for a considerable distance below present workings. The operators report that approximately 500 tons of ore have been produced from this section.

A short distance south-east of these workings another ore-shoot occurs on the hanging-wall of the main siliceous lode. There is a small open-cut and a shaft which is vertical to a depth of 40 ft. and inclined 80 deg. southerly for a further 12 ft. There are short drives from the shaft at a depth of 30 ft. The workings were not accessible but it is reported that oxidised ore occurs over a width of 1 ft. 6 in. for a distance of 6 ft. along the northerly drive. No significant ore was exposed in the southerly drive or in the shaft below this level.

To the north-west of the main workings near the second cross-fault a prospecting shaft has been sunk 30 ft. vertically and 35 ft. on a 75 deg. southerly underlie. The shaft prospected a low-grade hanging-wall ore-shoot but values had not improved sufficiently at the progress depth to give much encouragement for further exploration.

South Blockade (Fig. 8, point 5).—The siliceous lode formation extends over a width of more than 200 ft. in this section but the significant mineralisation is again towards the hanging-wall side. Early workings consist of an adit, a shaft, a small open-cut and a number of costeans. Four to five per cent. copper ore has been exposed over a width of 75 ft. in the adit which extends through the siliceous lode to the foot-wall schists. The shaft which is reported to have originally reached a depth of 100 ft. has been cleaned out to a depth of 60 ft. in preparation for further exploratory work. The shaft is vertical for 25 ft. then underlies southerly at 75 deg. Some recent production has come from an open-cut above the adit. Several narrow siliceous veins carrying malachite, chalcocite and cuprite have been exposed.

Large quantities of low-grade ore remain in the Blockade line of lode. These probably amount to some tens of thousands of tons of 4 per cent. ore. The easily accessible higher-grade ore has been largely worked out and the size and grade of the ore-shoots does not encourage extensive underground exploration. However, further production may be expected from shallow workings at present being extended.

Megaphone.

The lease is held by V. G. Dann. It is situated three miles east-south-east of the "Blockade." Access from Mount Isa is via the new Cloncurry road for 26 miles, thence 8 miles northerly by fair to rough vehicle track to the lease.

Production.—Very little production took place before the present operators commenced mining in 1953. Total recorded production to 1955 was 522 tons of ore containing 95·0 tons of copper (18.2 per cent. Cu).

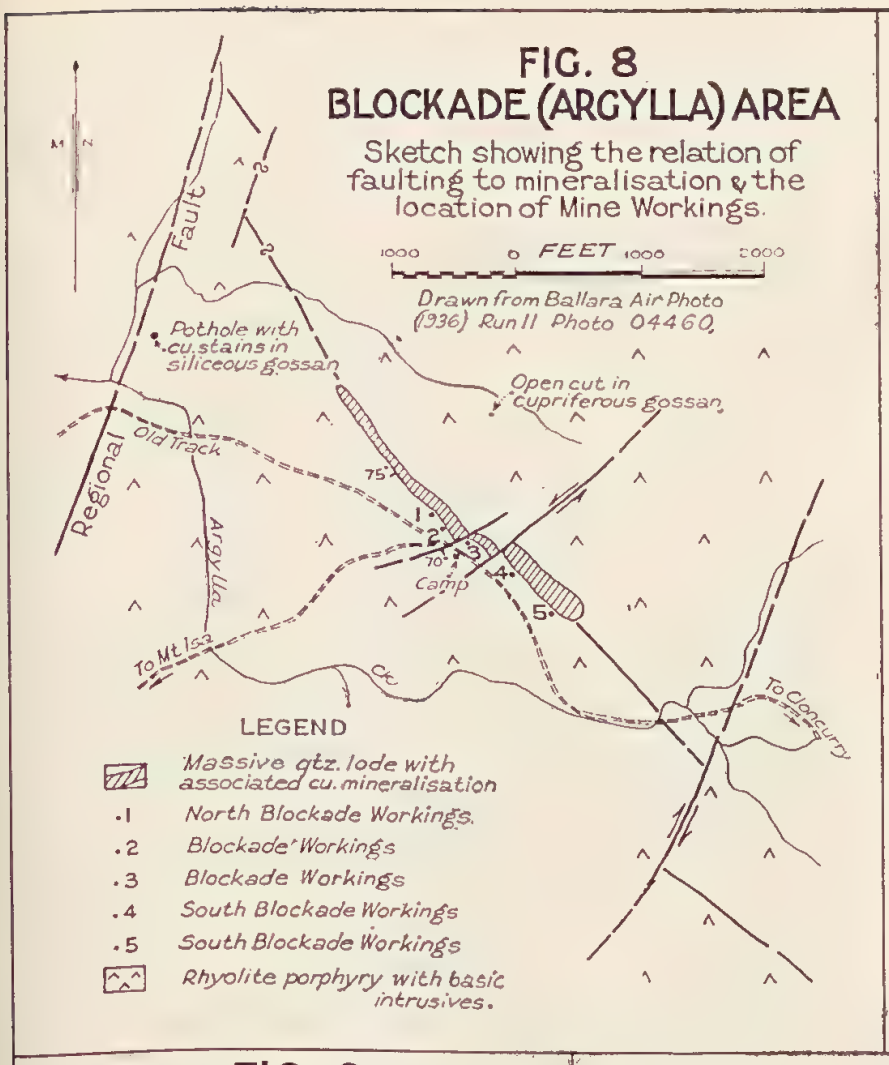


FIG. 8
BLOCKADE (ARGYLLA) AREA
Sketch showing the relation of faulting to mineralisation & the location of Mine Workings.
1000 0 FEET 1000 2000
Drawn from Ballara Air Photo (1936) Run II Photo 04460
Fault
Pothole with cu. stains in siliceous gossan
Open cut in cupriferous gossan
Regional
Old Track
Argylla
Camp
To Mt Isa
To Cloncurry
LEGEND
Massive qtz. lode with associated cu. mineralisation
.1 North Blockade Workings.
.2 Blockade Workings
.3 Blockade Workings
.4 South Blockade Workings
.5 South Blockade Workings
Rhyolite porphyry with basic intrusives.

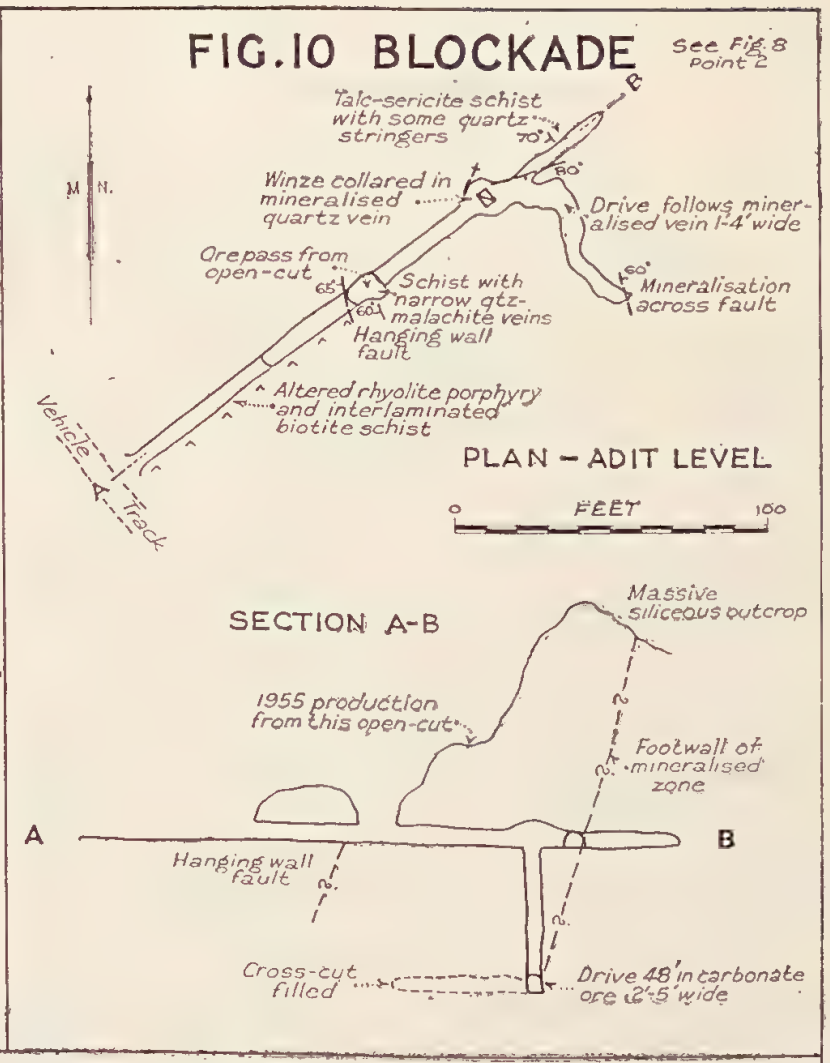
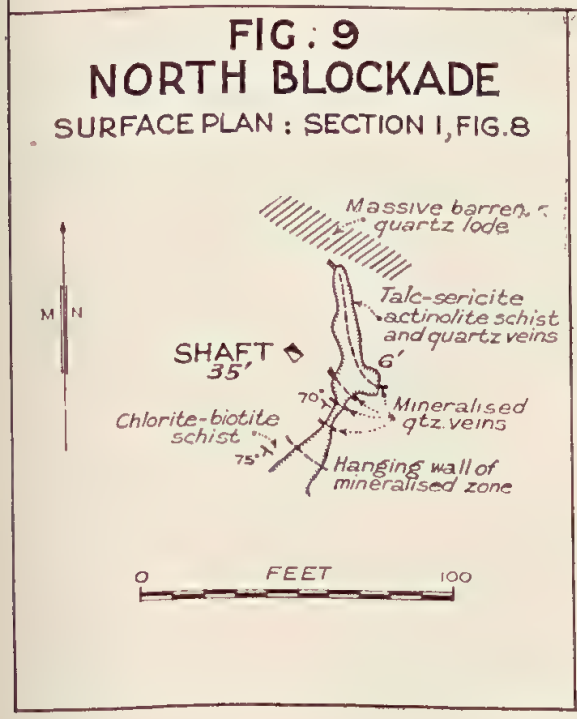
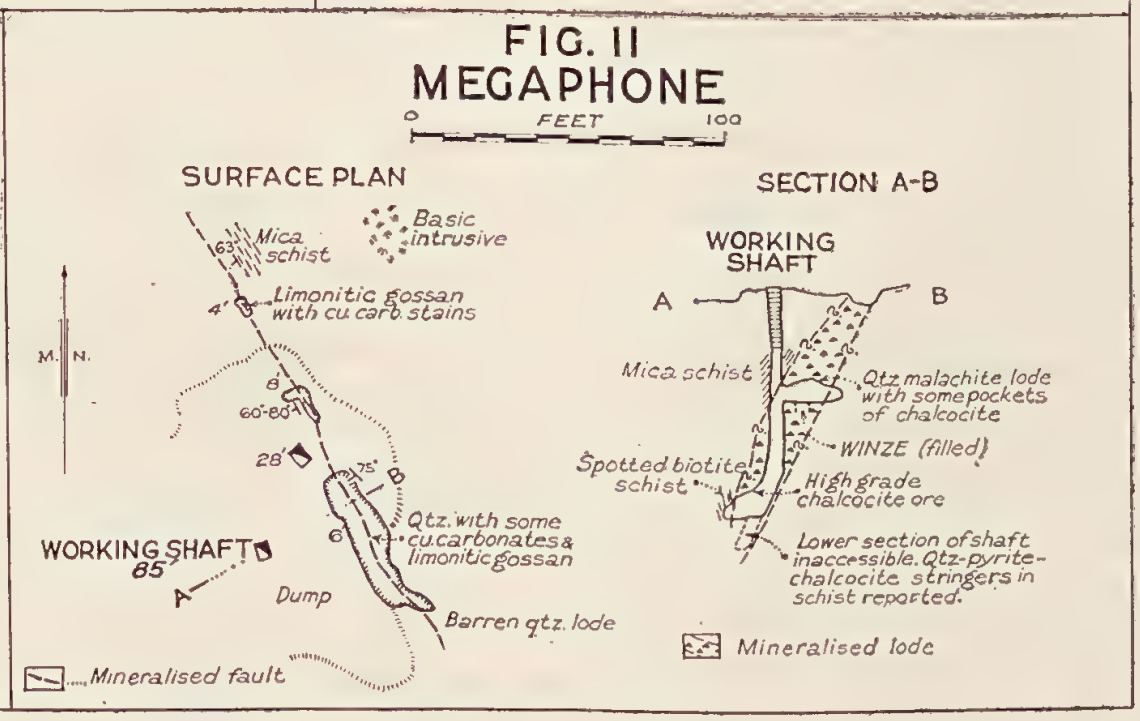


FIG. 10 BLOCKADE
See Fig. 8 Point 2
Talc-sericite schist with some quartz stringers
Winze collared in mineralised quartz vein
Drive follows mineralised vein 1-4' wide
Orepass from open-cut
Schist with narrow qtz-malachite veins
Mineralisation across fault
Hanging wall fault
Altered rhyolite porphyry and interlaminated biotite schist
Vehicle Track
PLAN – ADIT LEVEL
0 FEET 100
SECTION A-B
Massive siliceous outcrop
1955 production from this open-cut
Footwall of mineralised zone
Hanging wall fault
Cross-cut filled
Drive 48' in carbonate ore 2'-5' wide





Geology.—The outcrop of the deposit consists of limonitic gossan and quartz occurring along a fault line which strikes north 28 deg. west and dips south-west at 70 deg. The mineralised fault at the "Blockade" can be traced to within a short distance of the "Megaphone" and the two deposits are probably related to the same line of faulting. The country rocks are rhyolite porphyry with basic intrusives, and in the vicinity of the lode these have been metamorphosed to muscovite and biotite schist. The lode outcrop has a total length of 160 ft. and ranges in width up to 10 ft. The outcrop is leached and copper minerals consists of malachite with a little azurite and chalcocite.

Workings (Fig. 11).—Surface workings consist of several pits and an open-cut from which a small amount of ore was produced. A vertical shaft was sunk in the hanging-wall schists and this intersected siliceous lode material at approximately 30 ft. A crosscut at 37 ft. 6 in. for a distance of 20 ft. exposed quartz-malachite ore containing small pockets of chalcocite in quartz. Previous operators put down

a winze from the crosscut but this was subsequently filled with mullock. The present operators extended the shaft vertically to 60 ft. and then on an underlie of 70 deg. south-west to a depth of 85 ft. At the time of inspection the shaft was accessible to the 75-ft. level. From 60 ft. to 75 ft. an enriched zone consisting of high-grade chalcocite ore was penetrated. The ore is semi-oxidised near the base of this zone with the amount of primary sulphide increasing to 75 ft. At this depth it is reported that the chalcocite ore terminates sharply and below 75 ft. mineralisation is restricted to veins of quartz with pyrite and chalcopyrite, in biotite schist. The primary sulphide ore is reported to assay 4 per cent. Cu.

At the 75-ft. level drives extend 70 ft. north-westerly and 30 ft. south-easterly and some stoping above the level has been carried out adjacent to the shaft. The ore has a maximum width of 10 ft. near the shaft. The foot-wall of the lode is usually well defined and dips at 70 deg.-75 deg. south-west, but the hanging-wall is irregular and has a rolling outline. There is pronounced slickensiding on the contact of the lode with the hanging-wall biotite schist. This schist has caused some inconvenience in mining due to the tendency for it to "slab-off" along slickensided faces.

In the face of the north-westerly drive the lode has narrowed and split into foot-wall and hanging-wall sections which are separated by schist. These sections are 1 ft. 3 in. and 1 ft. wide, respectively. The weakening of mineralisation here may be attributed to a transverse fault which has resulted in a flexure of the lode. This flexure in the lode may be observed in the outcrop above the drive. Although the present face is not encouraging it is considered that some further driving is warranted from a consideration of the persistence of gossan in the outcrop of the lode.

The mineralisation has also weakened in the face of the south-easterly drive. Towards the floor the lode consists of bands of ore up to 1 ft. wide consisting of bornite and chalcocite in quartz and separated by bands of schist. A transgressive fault near the face of the drive again appears to have affected the distribution of copper mineralisation. In the back of the drive the ore is 4 ft. wide and a considerable amount of ore probably exists above the level. Some further driving to the south-east is warranted but significant mineralisation is not expected to persist in this direction.

BALLARA AREA.

Edna May.

The lease is held by J. Windus and was being worked under tribute by D. Laing. Road access from Mount Isa is by the new Cloncurry road for 16 miles, thence 13 miles south-east by fair to rough vehicle track to the mine.

The mine was earlier known as the "Willsburgh" and under this title a production of 499 tons of ore estimated to contain 21 per cent. Cu, is recorded. Production from the "Edna May" is recorded from 1938 to 1945 and again since 1953. To 1954 this amounted to 879 tons of ore containing 87·1 tons of copper (10 per cent. Cu). In addition, 3,000 tons of dump material averaging approximately 4 per cent. Cu, has been purchased by Mount Isa Mines Ltd. as cupriferous silica flux. A further 3,000 tons of similar material was being won principally from the glory-hole. Higher-grade pockets of oxide-carbonate ore were being selectively mined and sold as copper ore. In 1955 this amounted to 25 tons of ore for 2·7 tons of copper (10.8 per cent. Cu).

Geology.—The "Edna May" occurs in a belt of rugged hills consisting of rhyolite porphyry which is traversed by some minor basic intrusives. It is situated on the north-eastern side of a fault line which is marked by ferruginous quartz fault-filling. The fault ranges in strike from north 50 deg. west to north 30 deg. west and dips south-west. In the vicinity of the deposit the fault strikes north 30 deg. west and dips 80 deg. south-west. On the hanging-wall side of the fault the rhyolite has been kaolinised and impregnated with quartz, the intensity of alteration decreasing with distance from the fault line and the locus of copper mineralisation. The south-western margin of copper mineralisation is sharply defined by the fault line but to the north-east the mineralisation is disseminated and the margin is ill-defined.

It is reported that the outcrop of the deposit was extensively leached but at a shallow depth some high grade oxidised ore was encountered. Secondary copper mineralisation consists of disseminated carbonates and silicate over a length of at least 80 ft. and a maximum width of 50 ft. Pockets of high-grade cuprite and tile ore occur and are more abundant towards the hanging-wall of the lode. No primary ore has been encountered and considering the high topographic position of the deposit the depth of oxidation may be expected to extend much lower than present workings.

Workings (See Fig. 14).—These consist of a glory-hole, 30 ft. long, 16 ft. wide and 20 ft. deep which is connected by a shaft with the Adit level some 50 ft. below the base of the outcrop. On the Adit level the hanging-wall section of the deposit has been stoped towards the surface. The shaft from the glory-hole is reported to extend 50 ft. below the Adit level but this is now filled. The North winze situated on the hanging-wall of the lode at the end of the Main adit was sunk to a depth of at least 40 ft. but is now filled to 12 ft. The South winze is said to have been sunk to a depth of 50 ft. but is now filled to 25 ft. The present operators put in a crosscut from the Main adit to gain direct access to the South winze and were cleaning the winze out in preparation for developing this section of the lode below the Adit level. As the deposit appears to pitch steeply in a southerly direction it should be possible to adequately test the downward extension of the copper mineralisation from this winze.

A prospecting adit 70 ft. in a southerly direction from the Main adit was inaccessible at the time of inspection. It is reported that it penetrated across the fault line for a sufficient distance to adequately test any possible southern extension of the lode. No significant copper mineralisation was encountered. Adjacent to the fault line above this adit a prospecting pit shows malachite staining over a width of 3 ft. but the mineralisation is weak.

Considerable reserves of low-grade ore may be proved by further development of the deposit. To a depth of 50 ft. below the Adit level 10,000 tons of ore with a grade of the order of 4-5 per cent. Cu may be expected. There will be higher grade sections included in this block of ore but although these tend to be concentrated near the hanging-wall of the deposit no accurate prediction of their occurrence can be made. If the present arrangement of selling low-grade ore as cupriferous silica flux was continued it would be possible to systematically develop the deposit with a view to locating and extracting the high grade pockets of ore. Under normal mining conditions it is doubtful whether the overall grade of ore would enable economic development, and selective mining on a small scale would have to be resorted to.

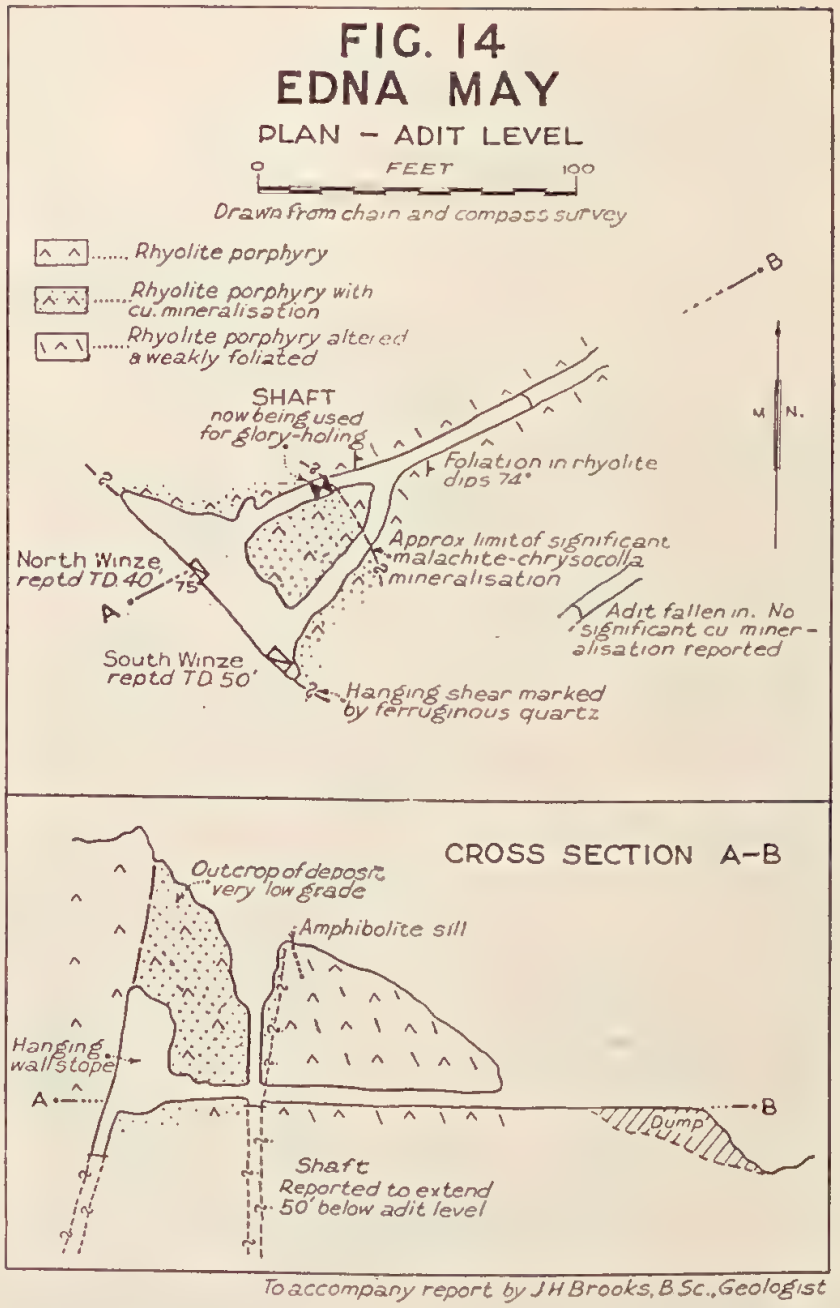


FIG. 14
EDNA MAY
PLAN – ADIT LEVEL
0 FEET 100
Drawn from chain and compass survey
Rhyolite porphyry
Rhyolite porphyry with cu. mineralisation
Rhyolite porphyry altered & weakly foliated
SHAFT now being used for glory-holing
Foliation in rhyolite dips 74°
Approx. limit of significant malachite-chrysocolla mineralisation
North Winze reptd TD 40'
South Winze reptd TD 50'
Adit fallen in. No significant cu mineralisation reported
Hanging shear marked by ferruginous quartz
A
B
N.
CROSS SECTION A–B
Outcrop of deposit very low grade
Amphibolite sill
Hanging wall stope
Dump
Shaft Reported to extend 50' below adit level

To accompany report by J H Brooks, B Sc., Geologist

Kings Cross.

The lease is held by R. and B. Windus. Access from Mount Isa is via the new Cloncurry road for 32 miles, thence 5 miles southerly by vehicle track to the lease.

Early mining operations.—Little is known of the early production from the mine which took place between 1906 and 1918. Most of the development work was carried out during the period that the property was owned by Mount Elliott Ltd. It is reported that an underlie shaft was sunk to 150 ft. and a drive was put in from the base for 95 ft. to the south-west. These workings are now inaccessible. Drives in both directions at "water-level" are also reported but no details are known.

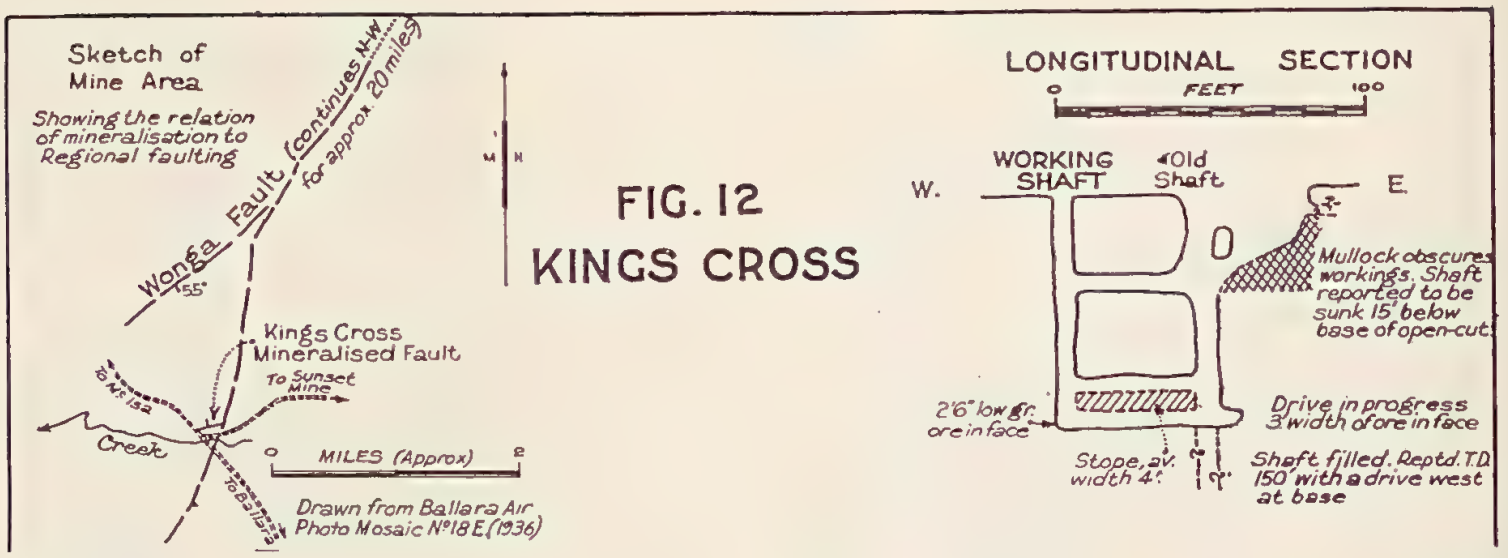
TABLE OF DATA.

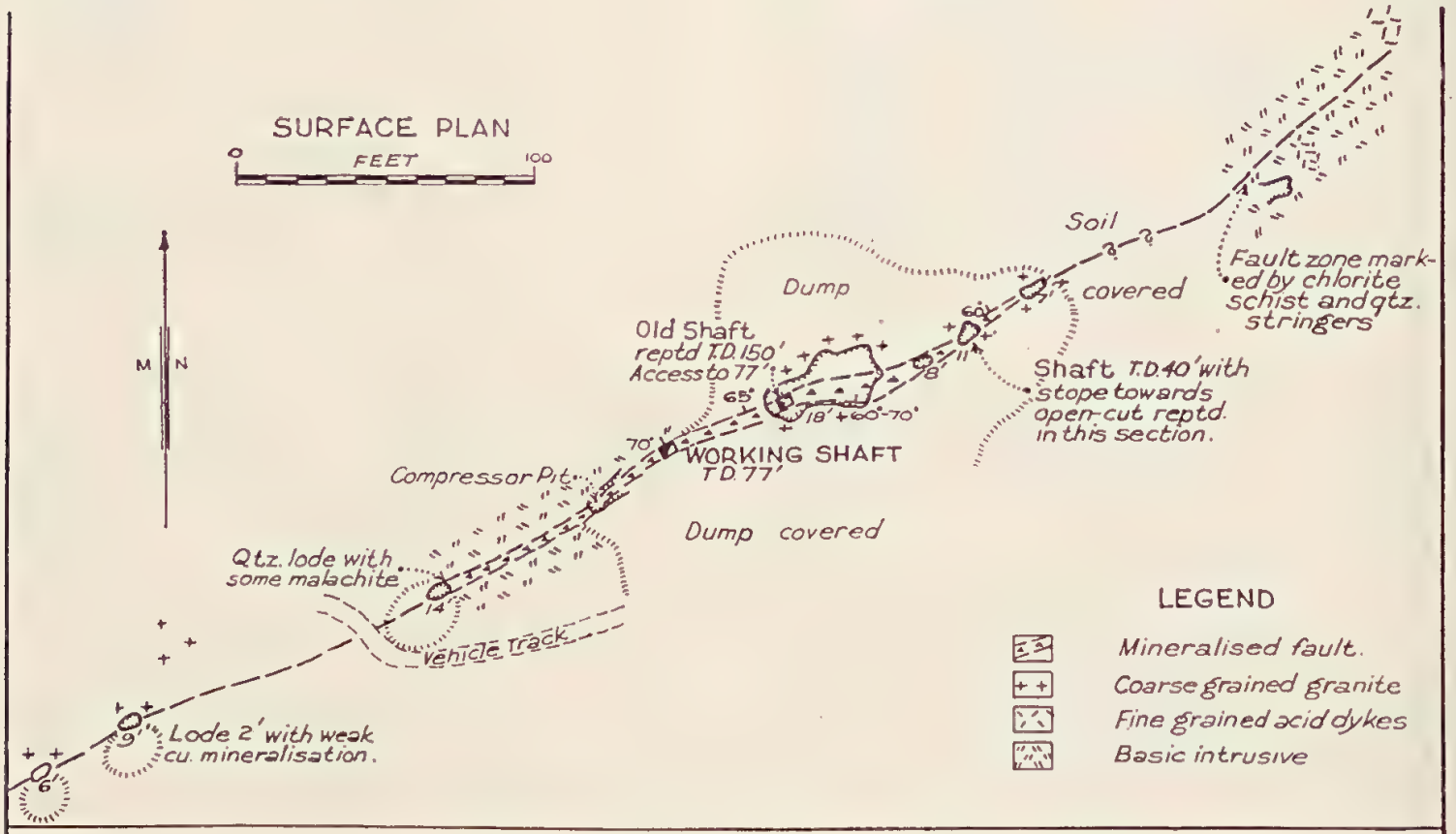
(Compiled from report by Honman 1938b).

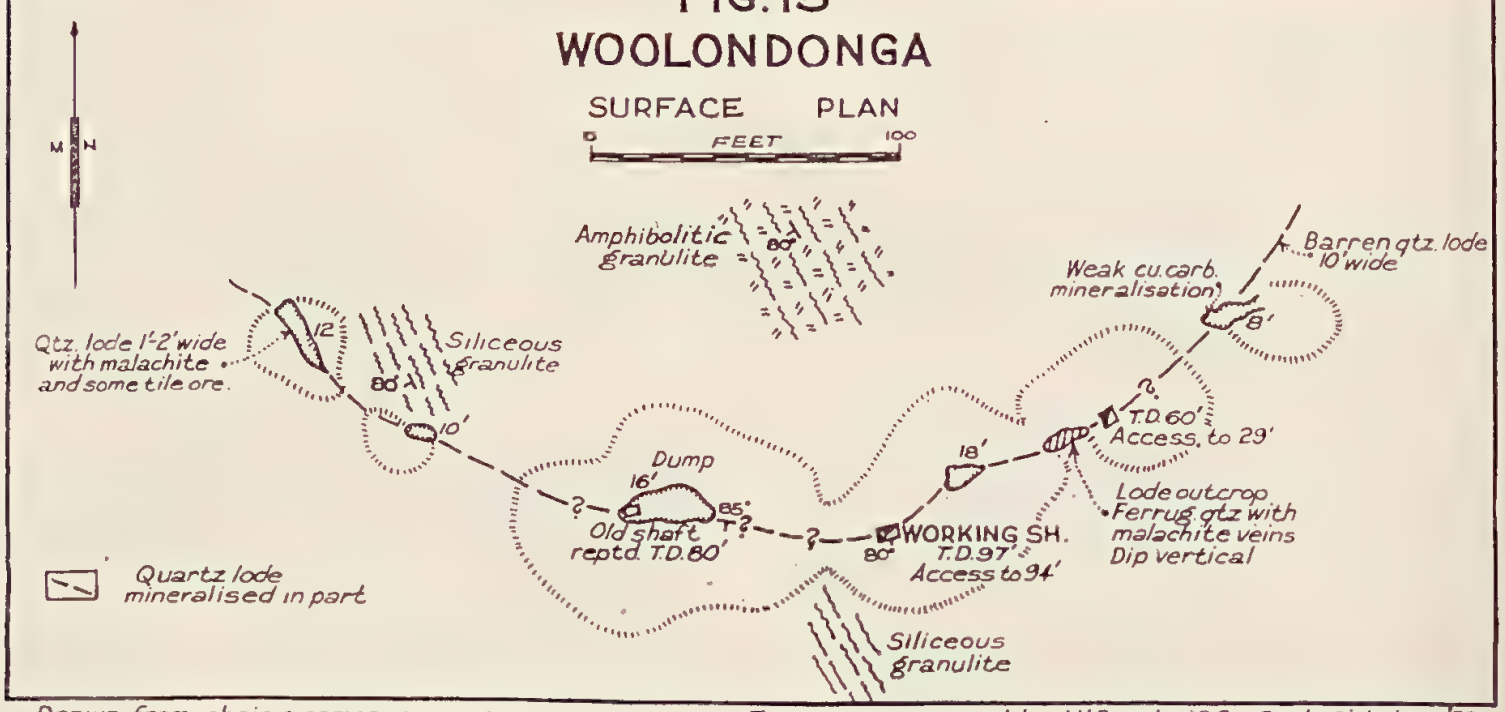
Underlie Shaft (depth in feet.)	Description.	South-West Drive at 150 deg. (distance in ft.)	Description.
0– 45	Low grade ore		
45– 60	Barren quartz	0–40	No Cu values
60–120	Lode 4 ft. wide; shoots of ore (8%–16% Cu) separated by barren sections, averaged 6% Cu overall	40–75	Low Cu values; lode 18 in. to 2 ft.
		75	Highest Cu values 6·9%
120–130	Ore pitches out of shaft to the south-west	80–90	No values
		90–95	Lode 3 ft. with "splashes" of ore
130–150	No Cu values		

Total recorded production to 1954 is 588 tons of ore of which 509 tons contained 58·5 tons of copper (11·5 per cent. Cu). In 1955, 285 tons of ore were produced containing 24·9 tons of copper (8·7 per cent. Cu).

Geology.—The country rocks consist of an igneous complex. Coarse grained granite predominates and amphibolitic basic intrusions also occur. Fine-grained acid dykes traverse both the coarse-grained granite and the basic intrusions. The fault in which the mineralisation occurs strikes north 60 deg. east and dips 70 deg. north-west. It is related to the Wonga regional fault (see Fig. 12) and the structural position of the "Kings Cross" may be compared with that of the "Referee" copper lode.


Sketch of Mine Area
Showing the relation of mineralisation to Regional faulting
Wonga Fault (continues N-W for approx 20 miles)
Kings Cross Mineralised Fault
To Sunset Mine
Creek
MILES (Approx)
Drawn from Ballara Air Photo Mosaic N°18 E.(1936)
FIG. 12
KINGS CROSS
LONGITUDINAL SECTION
FEET
WORKING SHAFT
Old Shaft
W.
E.
Mullock obscures workings. Shaft reported to be sunk 15' below base of open-cut
2'6" low gr. ore in face
Drive in progress 3' width of ore in face
Stope, av. width 4'
Shaft filled. Reptd. T.D. 150' with a drive west at base





Drawn from chain & compass surveys

To accompany report by J.H. Brooks, B.Sc., Geologist, June '56

Stains of malachite are widespread in the quartz fault-filling but mineralisation of economic significance is confined to a section of the lode where a flexure in the fault line probably caused ore localisation. Significant copper mineralisation extends over a length of approximately 100 ft. and an average width of 4 ft. The maximum width and intensity of mineralisation occurs towards the north-eastern end of the open-cut where the lode is 8 ft. wide. However, the width of economic ore is usually not more than 3 ft. The outcrop consists of limonite-quartz gossan carrying some copper carbonate and tile ore.

Workings (See Fig. 12).—Recent workings consist of an inclined shaft of vertical depth 77 ft. deep situated 40 ft. south-west of the old shaft previously mentioned. Drives north-east from the Working Shaft at depths of 32 ft., 65 ft. and 77 ft. connect with the Old Shaft which is inaccessible below the 77-ft. level. In the Working Shaft the lode ranges from 2 ft. to 5 ft. in width and averages 3 ft. 6 in. The foot-wall dips at 70 deg. north-west and is fairly regular in outline, whereas the hanging-wall has a rolling outline which causes the frequent bulges and pinches of the lode. In the shaft some low-grade oxidised ore was encountered near the surface but the lode is largely barren above a depth of 50 ft. Below this, semi-oxidised ore occurs and increases in grade to the base of the shaft. The ore consists of chalcopyrite interstitial to coarsely-granular quartz and a small, variable amount of secondary sulphides is also present. Chlorite, actinolite, and biotite occur in the gangue and are derived from the adjacent basic intrusive.

The lode has been stoped between the 65-ft. level and the 77-ft. level from the Working shaft to the Old Shaft. The average width of ore in the stope was approximately 4 ft. and the grade exceeded 8 per cent. Cu. At the time of the May, 1956, inspection the drive at the 77-ft. level was being extended east from the Old Shaft. A 3 ft. width of ore was exposed in the face of the drive. The ore consists of chalcopyrite in quartz and contains a considerable amount of chalcocite and tenorite along fracture planes. In the west face of the drive the lode is 2 ft. 6 in. wide and the ore is of rather low grade. Development at the 77-ft. level and below is expected to expose further ore and a continuance of small scale production is anticipated.

Sunset.

The lease is held by W. Watson. Access from Mount Isa is via the new Cloncurry road for 32 miles thence 10 miles by fair to rough vehicle track to the lease.

The main period of production from this deposit was between 1914 and 1918 when company records indicate that over 2,000 tons of ore assaying 15 per cent.–25 per cent. Cu were despatched for treatment. Mining was largely confined to open-cutting and tunnelling on at least 10 different cupriferous veins. The deepest shaft reported was 69 ft. and influxes of water appear to have been one of the main problems in developing the more promising veins at depth. Total production in official records to 1954 is 482 tons of ore containing 92·2 tons of copper (19 per cent. Cu). Production in 1955 amounted to 43 tons of ore containing 5·5 tons of copper (12·7 per cent. Cu).

The mineralisation occurs in a succession of calc-silicate rocks (recrystallised impure limestones) and amphibolitic basic igneous rocks. The copper deposits are of two types:—

(1) This type occurs in the southern portion of the lease and the mineralised veins appear to follow fissures or fractures in a lenticular body of crystalline calcite and calcite-amphibole rock. The strike of the veins ranges from north 5 deg. east to north 15 deg. east and the dip ranges from steep west to vertical. The ore-shoots usually pitch south an angles near 40 deg. The veins are usually not persistent in length and are less than 4 ft. in width. The outcrop consists of a ferruginous gossan with some copper carbonates. It is reported that some high-grade chalcocite ore was extracted but at a shallow depth chalcopyrite-pyrite ore occurs. The northernmost of these veins is the largest and most persistent and has been developed by open-cutting and stoping to the south. It has been mined over a length of approximately 80 ft. and averages 3 ft. 6 in. in width. The present leaseholder has cleaned out a working face in preparation for developing the ore-shoot further to the south.

(2) This type occurs in the northern portion of the lease. The outcrop consists of quartz and jasper with some limonitic gossan. Oxidised ore occurs in high-grade pockets usually concentrated by fractures and joints near the hanging-wall or foot-wall of the lode. The lodes have been developed in two localities by the present lease-holder. In the main section ore has been won from an open-cut 40 ft. long, 8 ft. wide and 35 ft. deep, and from a vertical shaft 25 ft. south of the open-cut which is 45 ft. deep. The lode formation is 6 ft. to 8 ft. wide. At the second locality 500 ft. to the north a prospecting shaft has been sunk 20 ft. on a lode which ranges in width up to 2 ft. The ore is low in grade and the prospects of improvement with depth are not good.

Woolondonga (Willandungar).

At the time of inspection the lease was held by C. W. Godfrey. It is situated 41 miles by road from Cloncurry. Access is via the new Mount Isa road for 18 miles thence 23 miles south-westerly by fair to rough vehicle track to the lease. It is 5 miles north-north-east of the "Mary Kathleen" uranium lease.

Production.—Recorded production to 1954 is 205 tons of ore of which 93 tons contained 16·0 tons of copper (17 per cent. Cu). Early production is not known and it would appear from mine workings that the actual production was much greater than these figures indicate. In 1955 production amounted to 110 tons ore containing 10·8 tons copper (9·8 per cent. Cu).

Geology.—The mineralised lode occurs in amphibolitic and siliceous granulite which forms part of a succession consisting largely of metamorphosed calcareous sediments and basic igneous rocks. The northern margin of the Mount Burstall granite occurs less than ½ mile to the south-east. The outcrop of the lode consisted of iron-stained quartz which contains variable amounts of limonitic gossan in the productive sections. The outcrop is largely leached but contains some malachite and tile ore. The lode has an irregular arcuate outline and can be traced over a distance 1,000 ft. The strike ranges from north 30 deg. east to north 45 deg. west and the lode dips steeply to the south or south-east. It is transgressive of the granulite country rocks which strike regularly at north 25 deg. west and dip west at 80 deg. In the vicinity of the mineralised lode the amphibolitic granulite has been altered to hornblende and biotite schist and the siliceous granulite has been kaolinised.

Workings (See Fig. 13).—The working shaft has a total depth of 97 ft. and was accessible to 94 ft. Ore of economic grade was reached at a depth of 25 ft. to 30 ft. and primary sulphide ore enriched by secondary sulphide and oxide was reached at approximately 70 ft. The quartz lode averages 4 ft. in width but the full width of lode does not always carry copper mineralisation. Significant mineralisation may be confined to the hanging-wall or foot-wall section of the lode. Small lenses of secondary copper sulphide and oxide occur in the hanging-wall country rocks usually in association with kaolinised granulite but it is not often that these lenses are large enough to be of economic significance.

In the west face at the 94-ft. level the quartz lode is 4 ft. 6 in. wide. High-grade ore is confined to a 2 ft. foot-wall section and the rest of the lode is only weakly mineralised. A band of amphibolite separates the hanging-wall and foot-wall sections of the lode. The ore consists of chalcopyrite, largely massive in form, and some covellite, chalcocite, and tenorite is also present. In the east face the quartz lode has narrowed to 1 ft. 6 in. of rather low-grade ore. Nearly 4 ft. into the hanging-wall country rocks a lens of black, powdery secondary ore occurs. This is 1 ft. wide in the face and is reported to widen to 2 ft. in the bottom of the shaft.

North-east of the working shaft a second shaft of total depth 60 ft. is accessible to 29 ft. At a depth of 29 ft. the lode is at least 6 ft. wide and consists of earthy limonite, quartz, and malachite. As this still represents the zone of leaching it will be necessary to clean the shaft out to a greater depth to determine whether ore of economic grade exists in this section of the lode.

The two open-cuts on the lode were productive of ore during early mining operations. It is reported that a considerable quantity of high-grade, semi-oxidised ore was obtained. Several pits have tested the extensions of the lode away from the main workings but have not been productive of more than token amounts of ore.

The operator of the mine intended to drive westerly from the working shaft at the 94-ft. level. Indications in the west face of the shaft are favourable but as the copper values vary considerably even over short distances it is difficult to predict what ore may be present in this section of the lode.

Non Pariel.

The lease was held by A. Wright and party. It is situated 9 miles south-west of the old Ballara railway station in the headwaters of the Malbon River and may be the "Lenore" lease referred to by Ball (1908). Access from Mount Isa is via the Duchess road to Woonigan Siding, thence easterly by vehicle track to the lease. The distance is roughly 65 miles. Nothing is known of early production. It is reported that the mine was abandoned due to heavy influxes of water. During 1955, 26 tons of ore have been produced containing 5·5 tons of copper (21 per cent. Cu). However, no appreciable further production can be expected unless the influx of water can be controlled to enable the persistence of the copper ore in depth to be tested.

Geology.—The deposit occurs in a succession of muscovite schist, amphibolite, biotitite, and rhyolite which have a meridional trend. The major Ballara (Fountain Range) Fault occurs less than one mile to the east. Copper mineralisation is associated with a quartz-breccia lode which can be traced in outcrop for a quarter of a mile. The strike ranges from north 20 deg. west to north 10 deg. east and dips 70 deg. east to vertical. The main copper deposit is situated near the southern end of the breccia lode and consists of cuprite with subordinate malachite, azurite, chalcocite and native copper. It is reported that high-grade ore occurred over a width of 4 ft. with disseminated carbonate mineralisation over a considerably greater width.

Workings.—The full extent of old workings is not known but the main shaft extended at least to a depth of 50 ft. A crosscut west for 7 ft. on the 30-ft. level has been reopened. A drive extended 14 ft. south from the end of the crosscut. A rich pocket of cuprite ore was stoped in this vicinity and the present operators have extracted a small quantity of the ore remaining. A shaft underlying 75 deg. east extended from a small open-cut and connected with workings on the 30 ft. level but this is now filled in. At 45 ft. a second crosscut extends 10 ft. but the mine is filled with water below the 30-ft. level and little is known of the lower workings.

About 100 yd. to the north on the breccia lode a prospecting shaft has been sunk to a depth of 24 ft. Stringers of cuprite ½ in. wide dip west towards the vertical quartz lode at the contact of which they pinch out. The occurrence does not appear to be of economic significance.

CLONCURRY AREA.

Chum.

The lease is held by E. G. Cummins. It is situated ¾ mile south-east of "Chumvale" homestead and is 10 miles from Cloncurry by graded vehicle track. Early recorded production amounts to 100 tons of 16·6 per cent. ore but the actual production was probably much greater than this. From 1953 to 1955, 225 tons of ore have been treated at Mount Isa for 14·5 tons of copper (6·4 per. cent. Cu). A small parcel of hand-picked ore has been sent to Port Kembla for treatment. No mining was in progress at the time of inspection.

Copper mineralisation is associated with a siliceous lode which can be traced over a length of 325 ft. The strike is north 80 deg. east and the lode dips steeply to the north. The area is largely soil-covered but some recrystallised impure limestone and massive quartzite occur near the deposit and a basic igneous rock is exposed in the open-cut. In the productive section of the lode the outcrop consists of siliceous limonitic gossan with sulphide boxwork in part and containing a little malachite and cuprite.

Old workings consist of an open-cut 65 ft. long, 15 ft. wide and 10 ft. deep. A shaft which is now filled in was sunk from the open-cut to a depth of 80 ft. to 100 ft. and a rich pocket of cuprite ore is reported to have been mined in workings from this shaft. Recent mining has been done from two shafts 50 ft. apart and situated west of the open-cut. The shafts are 33 ft. and 24 ft. deep and are connected at the base by a drive. The total length of driving is 85 ft. Copper ore is not continuous but consists of small, high-grade pockets of ore up to 6 ft. long and 4 ft. wide. The ore is usually tessellated in form, the minerals present being chalcopyrite, cuprite, chalcocite, and malachite.

No significant production can be expected in the future unless a considerable amount of developmental work is done and the grade does not give great encouragement to undertake this work.

Fairfield.

The lease is held by E. G. Cummins. Access from Cloncurry is via the new Mount Isa road for 12 miles, thence 1 mile southerly to the lease. Early recorded production amounts to 166 tons of 10 per cent. Cu ore but these figures are probably incomplete. It is reported that a parcel of cuprite ore has been sent to Port Kembla for treatment and in addition 39 tons of ore have been treated at Mount Isa for a return of 2·2 tons copper (6 per cent. Cu). No mining was in progress at the time of inspection.

The copper mineralisation is associated with a siliceous lode which ranges in strike from north 57 deg. east to north 87 deg. east and dips almost vertically. The lode can be traced over a length of 500 ft. in an area otherwise soil-covered. In the productive section of the lode, the outcrop consists of siliceous limonitic gossan with some sulphide boxwork and ferruginous jasper, over a width of 5 ft. Malachite and a little cuprite and chalcocite are present. The lode has been mined over a length of 90 ft. and the production has come from three small open-cuts 26 ft. deep. An old shaft which is now filled in is reported to have reached a depth of 120 ft. and high-grade ore consisting of cuprite, malachite, and chalcocite is said to have been produced.

DUCHESS AREA.

Mount Hope Group.

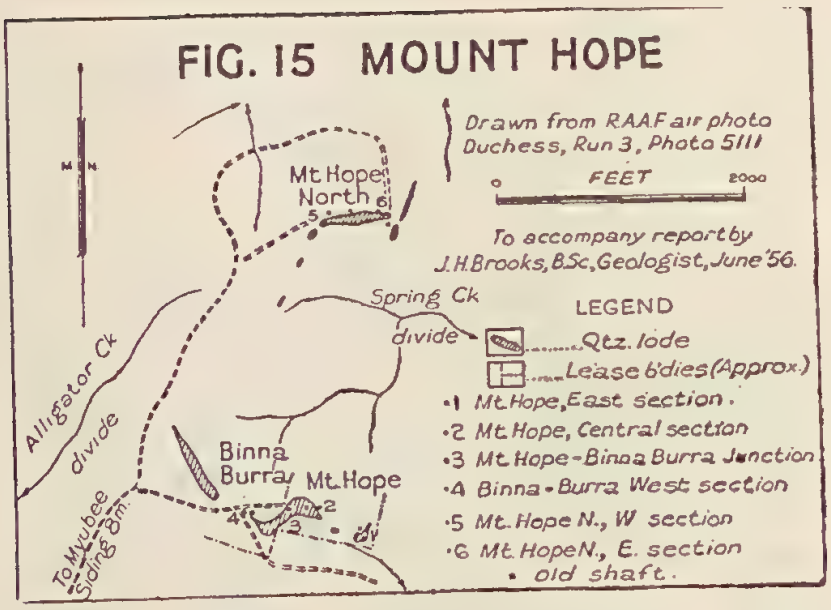
This group includes the "Mount Hope," "Binna Burra," and "Mount Hope North" leases. The leases are held by A. Groom. They are located 9 miles by vehicle track north-easterly from Myubee Siding which is 45 miles by rail from Mount Isa.

PRODUCTION TABLE.

Period.	Mount Hope.		Binna Burra.		Mount Hope North.		Green's Creek.	
	Ore.	Copper.	Ore.	Copper.	Ore.	Copper.	Ore.	Copper.
Before 1936 ..	114 (46·5)	14·5 (31%) (*a*)	Previously included in Mount Hope Lease (Ball 1908)		No early recorded production		Ore recorded under this name came from Mount Hope and Binna Burra	
1936–1954 ..	451	31·4 (7%)	79	4·5 (6%)	10	1·6 (16%)	93	7·1 (8%)
1955	329	19·8 (6%)	180	15·0 (8%)	78	7·1 (9%)	33	3·4 (10%)
Total . ..	894 (826)	65·7 (8%) (*a*)	259	19·5 (7%)	88	8·7 (10%)	126	10·5 (8%)

(*a*) Ore with copper contents known.

The country rocks in the area consist of biotite schist, quartz mica schist and schistose rhyolites. The strike is north 10 deg. west to north and the dip vertical. Small sill-like and lenticular bodies of quartz and pegmatite occur. The lode consists of massive quartz outcrops standing above the surrounding country and having a disjointed semi-circular outline. The massive quartz lode is largely barren although copper staining is widely distributed. Significant copper mineralisation is confined to a number of small ore-shoots whose occurrence can usually be related to structural



features. There is a complementary system of faults striking north-north-east and north-west which has a controlling influence in some cases and other ore-shoots are located along the margin of the barren quartz lode often where there is a change of strike.

Ore has been obtained from a number of localities (see locality plan Fig. 20) and these are described separately.

(1) East section of Mount Hope.—The main copper mineralisation is located near the intersection of a fault striking north 13 deg. east with the massive quartz lode which strikes north 80 deg. east. Ore consists of malachite and cuprite in a hematite-quartz gangue. Other pockets of siliceous malachite ore are located round the margin of the barren quartz lode but these are low in grade. Workings consist of an adit with a surface rise and some shallow pits. An old shaft is now inaccessible.

(2) Central Mount Hope Section.—An ore-shoot over 100 ft. long and 3 ft. to 4 ft. wide is associated with a fault striking north 45 deg. west which displaces the massive quartz lode. The ore occurs along the contact of the barren quartz lode with mica schist. Malachite and some small pockets of cuprite ore occur. The malachite has been deposited largely along joint planes in the quartz gangue. In this section the massive quartz lode is iron-stained and contains jasper, limonitic jasper, and some malachite. Workings consist of two open-cuts, shallow pits and an old shaft which is inaccessible. A large proportion of recent production has come from this section.

(3) Section near the junction of the Binna Burra and Mount Hope leases.—Here malachite ore occurs on the northern side of the massive quartz lode over a width of 5 ft. Pockets of ferruginous ore carrying copper oxide also occur. The massive quartz lode contains 60,000 tons of material above the general surface level assaying 1·3 per cent. Cu in the Binna Burra section of the lode*. Workings consist of a small open-cut and a crosscut adit which was advanced a distance of 24 ft. at the time of inspection.

*Mt. Isa Mines Ltd. data.

(4) West Binna Burra section.—Copper mineralisation is associated with a fault striking north 55 deg. west. The mineralisation was being tested by shaft-sinking at the time of inspection. The lode which is 3 ft. to 6 ft. in width improved in quality to a depth of 8 ft. and then deteriorated somewhat to the progress depth of 20 ft. The ore consists of ferruginous quartz carrying cuprite and some chalcopyrite, malachite and azurite. Some pits and a shaft (now inaccessible) previously explored the lode in this section.

(5) Western section of Mount Hope North.—A small ore-shoot 35 ft. long and 3 ft. to 5 ft. wide has been localised in a vertical fracture parallel to the surrounding massive quartz lode. The lode changes in strike from north 22 deg. east to north 42 deg. east in this section. The ore consists of quartz and kaolin carrying malachite and cuprite. A small quantity of ore has been won from an adit.

(6) Eastern section of Mount Hope North.—Some small high-grade pockets of cuprite ore have been mined from an ore-shoot along the northern margin of the barren quartz lode which strikes north 75 deg. east. Recent production has come from an adit. Other workings consist of two old shafts (now inaccessible) and several pits. The main lode is terminated against two *en echelon* faults which strike north 20 deg. east. The quartz fault-filling has some copper carbonates associated but no mineralisation of economic significance.

Some further production of low-grade secondary ore can be expected but the size and grade of the ore-shoots does not greatly encourage further underground exploration. Primary mineralisation is not expected to be of any significance.

KURIDALA AREA.

Young Australia.

The lease is held by J. Tunny and at the time of inspection the lease was under option to Cloncurry Uranium Ltd. It is situated 9 miles by bush track from Kuridala railway station and one mile north-west of "Agate Downs" homestead. Previously the lease was known as the "Monitor."

Up to 1954 recorded production was only 125 tons of ore containing 9·4 tons of copper (8 per cent. Cu) although 65 tons of 30 per cent.-40 per cent. ore was listed from the "Monitor" (Ball, 1908). In 1955, 145 tons of ore were produced for a return of 8·6 tons of copper (6 per cent. Cu).

The quartz lode was introduced along a fault line which strikes north 30 deg. east and dips from 75 deg. south-easterly to vertical. This strike is in conformity with the general strike of the country rocks. The country rocks are principally shales which are silicified in outcrop. The lode can be traced discontinuously for 1,000 ft. but the productive section is confined to a length of 110 ft. The margin of a major granite intrusion occurs one mile to the west.

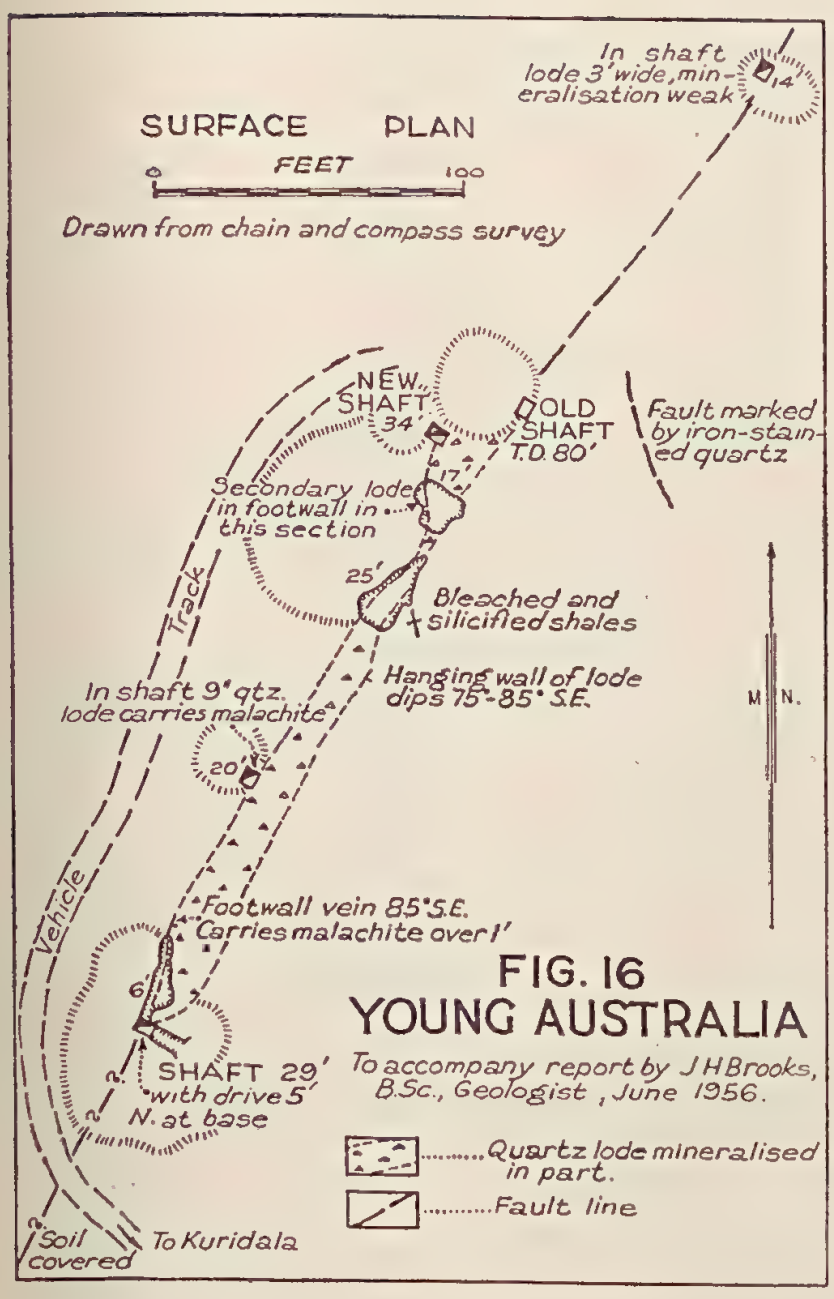


FIG. 16
YOUNG AUSTRALIA

Old workings consist of a shaft reported to have reached to a depth of 80 ft., with drives 15 ft. north and 20 ft. south from the base. A small quantity of chalcocite-malachite ore was stoped above these drives. The workings are now in a state of collapse. There are two small open-cuts connected by driving and from these a large pocket of chalcocite-rich ore was extracted. A stope extends 21 ft. north of the open-cut section. A secondary lode on the foot-wall side of the main lode has been partly developed by stoping from the northern open-cut section and has been productive of some ore.

A new shaft of depth 34 ft. is in the course of being sunk on the foot-wall of the lode between the open-cuts and the old shaft. Part of the recent production has been development ore taken from the east side of the shaft.

Elsewhere along the lode copper mineralisation is mainly confined to malachite veins and stains usually along the margins of the barren quartz lode. Three prospecting shafts and other shallow workings have failed to indicate mineralisation of economic significance. To the south of the workings shown on the accompanying plan, (Fig. 16) the surface is largely soil-covered. In this area a promising self-potential anomaly was obtained during reconnaissance geophysical work by the Bureau of Mineral Resources. This indicates the possibility of an ore-body occurring at depth but a detailed survey followed by diamond drilling would be necessary to test this possibility.

Hampden.

This mine is situated near the Kuridala railway station and is held by J. Tunny. Since 1953 some 1,395 tons of ore have been despatched for a return of 83.6 tons of copper (6 per cent. Cu). The "Hampden" mine was one of the largest producers in the Cloncurry Field in the early mining period and recent production of low-grade ore has come from dump material and surface workings.

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Brisbane, 1st August, 1956.

By Authority, A. H. TUCKER, Government Printer, Brisbane.

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 286

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 5. ROTHWELL HAIGH MINE AREA, NORTH IPSWICH

By A. K. DENMEAD, M.Sc.

PART 6. MORETON-MORETON EXTENDED MINE AREA

By A. K. DENMEAD, M.Sc.

APPENDIX

By B. W. HAWKINS, B.Sc., Assistant Geologist

BRISBANE
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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.
PART 5.—ROTHWELL HAIGH MINE AREA.

SUMMARY.

The report embodies the results of a diamond drilling campaign conducted by the Mines Department in 1953 in the Rothwell Haigh Area, Ipswich Coalfield. Five holes were drilled in a restricted area bounded by two parallel dip faults and reserves within this area are estimated at 1,220,000 tons. The reserves are confined to the lowest known seam outcropping in the area, the Benley, and all but 200,000 tons are in the top section with an average thickness of 4 ft. 4 in. It is estimated that there are in addition some 300,000 tons of coal in the top section between the Gulland Fault and the south-western boundary of the property. Average ash is just over 30 per cent., but tests done on core samples indicate that considerable improvement in quality can be effected by wet washing.

The report is accompanied by the following annexures:—

Fig. 1. Map showing geology, topography and boreholes.
Fig. 2. Map showing boreholes, mine workings and boundaries of measured reserves.
Fig. 3. A Locality Map.
Fig. 4. A Skeleton Map showing structure contours on the Benley Seam.
Fig. 5. A sheet showing generalised bore sections.
Fig. 6. A sheet showing two cross sections.
Fig. 7. A sheet showing detailed seam sections, core recoveries and sampling results.

Introduction.

This report sets out the results of a diamond drilling campaign conducted in the Rothwell Haigh Area during 1953 for the purpose of proving reserves in the Benley Seam. The three overlying seams on which the colliery has hitherto relied for its output are virtually worked out and as pithead facilities, including a railway siding and screening plant, are available it seemed desirable, before finally abandoning the property, to test the one remaining seam, the Benley. The Benley Seam was worked to a small extent many years ago by tunnels driven from the outcrop and one of them was reconditioned in 1947 by Messrs. Hart's Aberdare Collieries Pty. Ltd. This tunnel known as Rothwell Haigh Extended, ran into a major fault 308 yd. from the entrance. Failure to penetrate the fault led to the abandonment of the colliery towards the end of 1952, all available coal between the crop and the fault having by then been worked out.

The drilling was undertaken by the Mines Department at the request of the proprietors, Messrs. Hart's Aberdare Collieries Pty. Ltd., who claimed that there was a potential mine area on the Benley Seam within the boundaries of the Rothwell Haigh property. The matter was referred to the Coal Board who agreed that a potential mine area existed. Beyond (i.e., S.E. of) the fault that cut off the coal in Rothwell Haigh Extended Colliery there was, within the Rothwell Haigh property, an area of approximately 120 acres free from major faults, the whole of which was expected to be underlain by the Benley Seam. Five holes were bored in this area, ranging in depth from 178 ft. to 756 ft. and aggregating 2,451 ft. The campaign occupied the period 10th August, 1953, to 6th October, 1953. Three machines were employed. Cores were logged by A. K. Denmead, J. O. Cuthbert, A. M. McKenzie and J. B. Cameron. Field mapping was done by J. O. Cuthbert and B. W. Hawkins.

Geological Features.

Within the boundaries of the Rothwell Haigh Colliery property five coal seams crop out at the surface. The enclosing strata are shales with interbedded, mostly coarse felspathic sandstones, and they dip to the south-east at an average angle of 1 in 4½. In descending order the seams are:—

Fiery
Waterstown
Tivoli
Eclipse
Benley

Fiery Seam.—The outcrop of the Fiery Seam is found near the south-eastern boundary of the property and there are no reserves of any consequence available for exploitation. In borehole No. N.S. 69 in portion 72 the seam is split into two sections aggregating 27 ft. in thickness. The two sections, which are respectively 9 ft. and 18 ft. thick are separated by 18 ft. of shale, siltstone and fine sandstone.

Waterstown Seam.—The extent of the workings on the Waterstown Seam is not known. In the Old "Echo" Tunnel in portion 72 the seam is 3 ft. thick and includes a stone band one inch thick 13 in. from the roof. Core recovery in the two bores (N.S. 69 and N.S. 70) which penetrated the Waterstown Seam was too incomplete to enable any assessment to be made of the thickness or quality of the seam but in any case maximum possible reserves would be quite small.

Tivoli and Eclipse Seams.—Between the Gulland and Tivoli Faults these two seams are completely worked out.

Benley Seam.—The Benley Seam is approximately 250 ft. (pavement to pavement) below the Eclipse Seam in this area. It is a thick carbonaceous section with indefinite upper and lower limits. The greatest known thickness (in borehole No. N.S. 69) is 30 ft. Two sections have been worked and these occur towards the bottom of the seam. As exposed in Rothwell Haigh Extended Colliery the Top and Bottom Seams are respectively 4 ft. 7 in. and 4 ft. 2 in. thick and are separated by 2 ft. 6 in. of inferior coal, stone and "bluey." The Top Seam contains 4 ft. of coal in four bands, while in the Bottom Seam there are 3 ft. 3½ in. of coal in nine bands. Included in the strata separating the two worked sections there is a band of fawn-coloured siltstone or fine sandstone some 6 in. thick which has proved a most

valuable "marker," enabling the Top and Bottom Seams to be recognised beyond doubt in all five boreholes.

The Top Seam carries a persistent "badger" which in known exposures varies in thickness from 5 in. to 17 in. The thickness of the "badger" in borehole No. N.S. 74 could not be ascertained as the core was finely broken. The seam thickness varies from 4 ft. 3½ in. (in N.S. 70) to 6 ft. 8 in. (in N.S. 71 where the "badger" is 17 in. thick), but in this case only the section of the seam below the "badger" with a thickness of 3 ft. 3 in. and ash content of 26·5 per cent. is possibly workable.

The Bottom Seam is far from regular in its thickness and in the quality of the coal. The thickness in the boreholes ranged from 2 ft. 2 in. (in N.S. 70) to 4 ft. 2 in. (in N.S. 68). It is not an attractive seam and is possibly workable only in the shallow ground.

Faulting, &c.—The Rothwell Haigh area is traversed by two major dip faults, the Tivoli Fault on the north-east and the Gulland Fault on the south-west. The Tivoli Fault is parallel with and close to the north-eastern boundary of the property and there is no prospect of working the Benley Seam beyond it. The Gulland Fault is roughly parallel with the Tivoli Fault and some 33 chains south-west of it. The Gulland Fault is a somewhat complex dislocation which has a basaltic dyke associated with it in places. There is a considerable area (approximately 40 acres) underlain by the Benley Seam between the Gulland Fault and the south-western boundary of the property in which the seam, if workable, would probably have to be exploited by a separate opening. The mine plans show only two minor faults between the two major dip faults.

Nature of the Coal.

The coal is a medium-volatile bituminous coal with low moisture content. Fixed carbon (dry mineral matter-free basis) ranges from 71·52 per cent. to 75·60 per cent and averages 73·51 per cent.

Both seams carry a noticeable proportion of inferior coal and "bluey" which accounts in a measure for the generally high ash content of the samples after exclusion of the major shale bands. Coking tests showed the coal to have moderately good swelling properties (swelling index 3½ to 5). The coke is classified as either "Cm" or "Cw" (medium or weakly coking). Calorific value of coal containing 25 per cent. ash is approximately 11,000 B.T.U./lb.

Washability tests were carried out on three samples, viz. the Top Seam in Borehole No. N.S. 71, the Top Seam in Borehole No. N.S. 74 and the Bottom Seam in Borehole No. N.S. 74. The samples, which had previously been crushed to minus ½ in. size, were screened into +14 mesh and —14 mesh portions. The washability tests were done on the +14 mesh portion which amounted to between ⅔ and ¾ of the samples. The tests showed that by rejecting the fraction that sank at specific gravity 1·8, which amounted to between ⅕ and ¼ of the washed material, a product was obtained giving an ash yield of between 20 and 26 per cent.

TABLE SHOWING WASHABILITY TESTS ON 3 BOREHOLE SAMPLES FROM ROTHWELL HAIGH MINE AREA.

	467/54 G. S.	468/54 G. S.	469/54 G. S.
Sample No.			
Ash—per cent.	26·5	31·6	32·2
Specific Gravity	1·528	1·577	1·578
The samples were screened into two portions—			
+ 14 mesh—per cent.	72·7	72·4	63·1
— 14 mesh—per cent.	27·3	27·6	36·9
Ash on — 14 mesh—per cent.	23·0	25·4	25·3
Washability Tests on + 14 mesh portion—			
Floats at 1·40 weight—per cent.	32·6	36·5	10·7
Ash content—per cent.	12·5	10·5	8·5
Floats at 1·60 weight—per cent.	38·2	21·6	47·3
Ash content—per cent.	25·5	25·0	22·4
Floats at 1·80 weight—per cent.	12·4	16·0	20·2
Ash content—per cent.	42·1	42·3	42·0
Sinks at 1·80 weight—per cent.	16·8	25·9	21·8
Ash content—per cent.	73·9	66·0	70·0
Composite of Floats—1·4; 1·6; 1·8.			
Proximate Analysis—			
Moisture at 105° C—per cent.	1·4	1·6	1·4
Volatile Matter—per cent.	20·0	21·5	20·1
Fixed Carbon—per cent.	56·0	55·2	52·8
Ash—per cent.	22·6	21·7	25·7
	100·0	100·0	100·0
Joules per gm	26,940	27,030	25,680
B. Th. U. per lb.	11,590	11,630	11,050
Sulphur (S)—per cent.	0·29	0·34	0·30

Sample 467/54 G. S.—Benley Top Seam in Borehole No. N. S. 71.
Sample 468/54 G. S.—Benley Top Seam in Borehole No. N. S. 74.
Sample 569/54 G. S.—Benley Bottom Seam in Borehole No. N. S. 74.

Reserves.

In the Top Seam the average thickness in five holes (excluding the "badger" and in the case of borehole No. N.S. 71 the top section also) is 4 ft. 4in. Average weighted ash (again excluding the "badger") is 30·2 per cent. Average specific gravity is 1·560. Measured reserves in the area bounded on the north-west by the fault in Rothwell Haigh Extended Colliery, on the north-east by the Tivoli Fault, on the south-west by the Gulland Fault and on the south-east by the property boundary (122·5 ac.) are estimated at 1,020,000 tons. Indicated reserves in the area between the Gulland Fault and the south-western boundary of the property are estimated at 320,000 tons.

In the Bottom Seam it is expected that there will be some 30 acres of coal of approximately the same quality as that mined in Rothwell Haigh Extended Colliery with an average thickness of 3 ft. 6 in. to 3 ft. 9 in. Reserves, which would fit best into the category of "indicated," would be of the order of 200,000 tons.

Conclusion.

The drilling has revealed total reserves of the order of 1½ million tons of which all but 200,000 tons are in one seam. The quality of the coal while not high, is comparable with that of other North Ipswich coals and tests have shown that it can be materially improved by wet washing.

On a 250 tons a day output and allowing for a 60 per cent. extraction the life of the mine would be 15 years. As the greater part of the area is free from faults and other disturbances it is felt that there is a sound basis for proceeding with the vigorous development of a new pit.

A. K. Denmead,
Assistant Chief Government Geologist.
10th November, 1955.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.
PART 6.—MORETON-MORETON EXTENDED MINE AREA.

With an Appendix on "Moreton Extended Colliery" by B. W. Hawkins, B.Sc., Geologist.

SUMMARY.

The Moreton-Moreton Extended Mine Area is based on the Moreton & Moreton Extended Collieries which at the time when the boring was commenced were working respectively the Eclipse and Fiery Seams. The eight holes drilled in this programme had an aggregate footage of 7,535. The drilling demonstrated that of the six main seams known to exist in the area only three had reserves of workable coal and none was workable throughout the bored area.

The seams, which all lie within the Tivoli "Stage" of the Ipswich Coal Measures of Triassic age, are banded and will require beneficiation after mining. All seams outcrop to the north of the drilled area and dip in a SSE direction at an average grade of 1 in 4½, reaching a maximum vertical depth (in the case of the Eclipse Seam) of 1,183 ft.

The coal is high volatile bituminous with high inherent ash but low moisture (usually less than 2 per cent.) and sulphur (max. 0·33 per cent.). When cleaned it makes a good metallurgical coke.

Measured reserves in three seams (the Eclipse, Fiery and Garden) are estimated at 3,700,000 tons of which no more than one half is expected to be available for extraction due to their situation under built-up areas and the necessity of washing the coal after extraction. It is believed that there are reserves totalling some 2,000,000 tons under the Railway Workshops Reserve and there are prospects of large additional tonnages to the south of the bored area.

Introduction.

Moreton Colliery, which is one of the oldest pits in the Ipswich Coalfield, has during the course of time changed its name three times. Known originally as the Eastwood Mine, it was subsequently re-named Mihi and later still Klondyke. It received its present name Moreton, when it changed hands in 1948. Four seams have been worked in the property of which the Eclipse (often spoken of as the "Mihi") has been by far the most productive. Work is at present confined to this seam.

Moreton Extended Colliery was opened up in 1949 by the proprietors of Moreton Colliery on the Fiery Seam. It has been operated on a small scale and the workings are not extensive.

As there seemed to be a prospect of a large output from one or both of these collieries it was decided to bore the area before resuming the programme mapped out by Messrs. Powell Duffryn Technical Services Ltd. The drilling occupied a period of 23 weeks commencing on the 28th September, 1953. Eight holes were bored, six on the north side of the Bremer River and two in Basin Pocket. Three machines were employed for the whole period. Depths of holes ranged from 655 ft. to 1,213 ft. and aggregated 7,535 ft.

Cores were logged by A. K. Denmead, J. O. Cuthbert, B. W. Hawkins and J. B. Cameron. The geological mapping in the main is the work of J. O. Cuthbert, supplemented by detailed work in certain localities by B. W. Hawkins and H. R. E. Staines. Underground inspections and sampling were done by B. W. Hawkins.

It was planned to space the bores on 20 chain centres but close settlement made this impossible and in consequence the holes are rather irregularly spaced.

This report is accompanied by the undermentioned plans and diagrams:—

Fig. 1. A map showing survey grid, borehole locations, surface contours and geology, and a locality map.

Fig. 2. A map showing survey grid, borehole locations, outlines of underground workings (with sample locations), areas within which reserves have been calculated.

Fig. 3. A sheet showing cross sections.

Fig. 4. A sheet showing generalised bore sections.

Figs. 5–7. Diagrams showing detailed seam sections in boreholes, with core recoveries. Fig. 7 also includes a seam section in Moreton Colliery.

Figs. 8–10. Skeleton plans showing structure contours on Garden, Fiery and Eclipse Seams respectively.

Geological Features.

Geological formations of Recent and Triassic age occur within the bored area (see Figs. 1, 3 and 4).

Alluvium.—River alluvium was intersected in boreholes Nos. N.S. 76, N.S. 77 and N.S. 80. The first-named was close to the Railway Reserve where there is an area of high-level alluvium that apparently has no direct connection with the Bremer River. Surprisingly the two holes drilled in Basin Pocket did not penetrate any recognisable Tertiary strata, passing directly from alluvium to Ipswich Coal Measures. There are outcropping sediments and

basalt of Tertiary age in Basin Pocket on the south side of the Bremer River and it had been supposed that Tertiary beds would be found underlying the river alluvium over the whole of the "Pocket." The greatest thickness of alluvium—clay and sand—penetrated was 85 ft. in borehole No. N.S. 77, where the base of the alluvium was 18 ft. below sea level.

Ipswich Coal Measures.—In this area the coal measures include the lower part of the Cooneana "Stage" and the Abermain productive beds which form the upper portion of the Tivoli "Stage". The greatest thickness of strata penetrated in any borehole was 1,190 ft. (in N.S. 79). They comprise shale, siltstone and sandstone which is always felspathic, usually coarse and sometimes pebbly. In general the standstone is non-porous and very strongly cemented. Over the greater part of the bored area the strata dip to the south-south-east at an average angle of 12 degrees. At the extreme west of the area the dip changes to south-east, due to the folding which everywhere affects the coal measures approaching the great West Ipswich "Fault." Of the eight or so seams and coaly sections tested only three are of any present economic interest. The seams tested are, in descending order:—

Unnamed Seam
Interval 100–130 ft.

Garden Seam
Interval 110 ft.

Tantivy Seam
Interval 150–200 ft.

Fiery Seam
Interval 70–80 ft.

Waterstown Seam
Interval 120–160 ft.

Tivoli Group of Seams
Interval 60–70 ft.

Eclipse Seam
Interval 80 ft.

Francis Seam

The Moreton seams are similar in their physical characters, as well as in type and rank, to North Ipswich seams in other areas.

The seams are generally banded and contain a notable proportion of high-ash coal, as well as "bluey" and carbonaceous shale. When of reasonably good quality the coal is soft and friable and strongly cleated. Sulphur content varied but little in the core samples, ranging from 0·22 per cent. to 0·33 per cent. and averaging 0·28 per cent. Moisture ranged from 1·3 per cent. to 2·4 per cent. and averaged 1·6 per cent. The fixed carbon on a dry, mineral-matter free basis (Parr Formula) varied from 62·6 per cent. to 67·9 per cent. On the basis of the bore samples there appears to be a definite increase in fixed carbon from the Garden Seam (F.C.—three samples —64·4 per cent.) through the Fiery Seam (F.C.—nine samples—65·3 per cent.) to the Eclipse Seam (F.C.—six samples—66·7 per cent.), evidently indicating an increase in metamorphism with increasing cover.

The coal is all good coking coal, having a swelling index ranging from 3½ to 7. All the samples tested except one were classified as "Cm" (medium coking).

Unnamed Seam 100–130 *ft. above Garden Seam.*—A seam, which may be identical with one of the upper seams of the Haighmoor area, lying between 100 and 130 ft. above the Garden Seam, was penetrated in every hole that was commenced at a sufficiently high horizon. This seam, which varied from 6 ft. to 14 ft. in thickness, was everywhere excessively banded and did not have a workable section in any hole.

Garden Seam (see diagram, Fig. 7 and Table 2).—This is the uppermost of the worked seams of the North Ipswich mining district. In the early days of the field it was worked from a number of openings at the outcrop over a length of threequarters of a mile in the Waterstown and Tivoli Estates. Nothing can now be seen of it in any of the old tunnels. The seam showed a workable section in three of the four deepest holes (Nos. N.S. 77, N.S. 79, N.S. 80), the best section being in borehole No. N.S. 79 where it was 8 ft. 8½ in. thick and showed 21·4 per cent. ash after 8¼ in. of stone and "boulder" (in 4 bands) had been excluded. It was unworkable in borehole No. N.S. 78. Of the shallower holes one (N.S. 73) showed an unworkable section; a second (N.S. 72) went through old workings, while in borehole No. N.S. 76 the coal was not cored. The remaining shallow hole (N.S. 75) was commenced at an horizon below the Garden Seam.

On the evidence of the three deep holes, Nos. N.S. 77, N.S. 79 and N.S. 80, it is considered that there must be substantial reserves in the Garden Seam in and adjacent to the bored area, but as these holes are practically co-linear only moderate reserves can be regarded as assured.

Tantivy Seam (See Fig. 7).—The Tantivy Seam lies usually about 110 ft below the Garden Seam. It was mined to a small extent in the old Tantivy Colliery whose workings extend to within 5 chains of borehole No. N.S. 72. In this pit the seam was 5 ft. 8 in. thick but only the bottom 3 ft. 4 in. were worked.

The Tantivy seam was identified in all but two holes. The thickness varied from 3 ft. 3½ in. to 5 ft. 5 in. The seam is excessively banded throughout and much of the coal is of inferior quality. The best section was in borehole N.S. 80 where the seam was 5 ft. 0¼ in. thick and contained 14 bands of stone with an aggregate thickness of 9½ in. A sample which included all the bands gave an ash yield of 32·3 per cent.

Fiery Seam (See diagrams, Fig. 6, and Table 2).—This was one of the main objectives of the drilling campaign. The Fiery is a thick seam characterised by the large number of bands of shale and "bluey" which it contains and by rapid lateral

changes in the thickness of the coal and shale plies. Excluding borehole No. N.S. 78, where the seam showed a marked deterioration, the average thickness of the Fiery Seam in the Moreton area, based on borehole measurements, is a little over 27 ft.

In the Moreton Extended Colliery the bottom eight feet or so of the seam are worked, the remainder being excessively banded and the coal of very inferior quality. Even the worked section is subject to rapid variations in the quality of the coal and in the thickness of the stone bands, and many faces have been abandoned due to these causes. The sections accompanying Appendix I. ("Moreton Extended Colliery" by B. W. Hawkins) illustrate this point.

The boring revealed a similar state of affairs over the whole of the bored area. The only sections of the seam that gave any promise were the top 3 to 7 ft. and the bottom 7 to 8 ft. In no case was the full section of the seam possibly workable. The ash in nearly all sections was high.

The following table shows the analysed sections in the various bores:—

TABLE 1.

MORETON–MORETON EXTENDED MINE AREA—TABLE SHOWING ANALYSED SECTIONS OF FIERY SEAM IN BOREHOLES.

Borehole (N. S. No.)	Total Thickness.		Sections Sampled Thickness.		Ash.	Position in Seam.	Remarks.
	Ft.	in.	Ft.	in.	Per cent.		
72	23	6	1	6¾	26·6	Bottom ..	Sampled sections 2′5″ apart.
			6	9¾	36·5	Bottom ..	
73	28	6½	1	2¼	40·2	Top	The 2 top sections separated by 11″ shale and "bluey". 2¼″ "boulder" excluded from bottom section.
			3	11½	24·8	Top	
			7	9	31·4	Bottom ..	
75	27	7¾	3	1½	34·5	Top	2½″ "boulder" excluded from bottom section.
			9	2¼	35·2	Bottom ..	
76	26	7½	7	0½	30·3	Top	3½″ "boulder" excluded from top section.
			7	5	43·7	Middle	
			3	7¾	35·8	Middle	
77	25	0¼	Not analysed				
78	13	2¼	Not analysed				Seam split in 2 sections 40 ft. apart.
79	32	7½	Not analysed				
80	26	8¼	10	3	40·1	Top	Top section 5 ft. from roof of seam.
			2	8½	25·1	Middle	
			5	4¾	40·4	Bottom ..	

In Moreton Extended Colliery the Fiery Seam became unworkable only a few yards east of the main dip. The deterioration seems to be fairly general in the eastern part of the area, as, with the possible exception of N.S. 72, where the bottom 6 ft. 9¾ in. of the seam had an ash content of 36·5 per cent. the bores drilled in this direction (including N.S. 69—Rothwell Haigh Area) showed the seam to be inferior from roof to floor. There is also evidence of deterioration in the southern part of the area. The bottom section in borehole No. N.S. 80 was markedly inferior to that in N.S. 73 to the rise, while in borehole No. N.S. 79 to the west there was no possibly workable section. In view of the erratic behaviour of the seam in Moreton Extended Colliery it is considered that there is no sound basis for estimating reserves. However, it seems very probable that within the area enclosed by a line joining the lowest colliery workings to borehole N.S. 75, thence to borehole N.S. 76, thence to borehole N.S. 80, thence to borehole N.S. 73, and thence back to the colliery workings there will be in the bottom section of the seam substantial reserves of coal of much the same quality and thickness as in the colliery itself. It is probable also that areas of inferior coal will be encountered, as in the colliery.

In the top section of the seam workable coal has been proved over an area of 70·8 acres, embracing boreholes N.S. 73, N.S. 75, N.S. 76, in which the average thickness of the seam is estimated to be 4 ft. 8½ in. It is considered unlikely that workable coal will extend far beyond this area.

Washability tests carried out on core samples show that for coal having an ash range of 30 to 37 per cent. the fraction having specific gravity not exceeding 1·8 constitutes between 74 and 85 per cent. of the whole and has an ash range of 19·4 to 24·3 per cent. (see Table 3).

Waterstown Seam.—This seam did not show a possibly workable section in any hole. It was non-existent in two holes and very stony in all the others. The best section was in borehole N.S. 80, where the seam was 4 ft. 2¼ in. thick and included 2 ft. 0¾ in. of coal in seven bands. In the Moreton area the Waterstown Seam lies between 70 and 80 ft. below the Fiery Seam.

Tivoli Group of Seams.—No fewer than five seams or carbonaceous sections have been mapped between the Waterstown Seam and the Eclipse Seam in this area. These seams are highly lenticular, and it was found impossible to correlate the "seams" penetrated by the bores with those mapped at the surface. To mention only one example of the correlation problems arising from such lenticularity there are in the vicinity of the Moreton pithead five outcropping seams in this stratigraphic range, two of which, the "Top" Seam and the "Poverty" Seam, have been worked, whereas in the nearest borehole, No. N.S. 75, which is less than half a mile away, only two inferior seams were pentrated in the same interval. While the Tivoli Seam has been traced at the outcrop from Rothwell Haigh Colliery with a reasonable degree of certainty it could not be positively identified in any borehole. None of the seams of the Tivoli group showed a workable section in any of the boreholes.

Eclipse Seam (See Fig. 5 and Table 2).—This seam has been worked extensively in the Moreton (formerly Klondyke) Colliery by means of tunnels driven from the outcrop. The overall thickness of the seam in the colliery is 10 ft. to 10 ft. 6 in. The portion of the seam mined has varied from time to time. For many years only the "middles" or main seam, measuring 4 ft. 6in. to 5 ft. 3 in. in thickness, was worked. Subsequently they worked the "dirty tops" over a limited area. This is a band of coal 12 to 18 in. thick separated from the main seam by some 18 in. of coal and stone bands. In recent years it has been the practice to work the "middles" and in some places also the "dirty bottoms," comprising a "badger" 12 to 14 in. thick on top and 18 in. or so of coal underneath. The cores were sampled on the assumption that the full section of the seam would be worked in the proposed new colliery, and hence, except in boreholes Nos. N.S. 72 (where the top half of the seam was impossibly dirty) and N.S. 80 (where a 7¾ in. "badger" was excluded) the full section of the seam was sampled. In calculating reserves only the seam section that was actually visible in the pit was used, but in the case of boreholes Nos. N.S. 75, N.S. 76, N.S. 79 and N.S. 80 the entire thickness sampled was used.

In the Moreton Colliery the coal has been found to deteriorate and become unworkable along a line going south-south-east from the outcrop in Pine Mountain Road. This "want" has been proved by the drilling in this and the adjacent Rothwell Haigh area to be very extensive. It persists at least as far as borehole No. N.S. 69, situated near the intersection of Tivoli Hill Road and Mount Crosby Road, where the seam was less than five feet thick and contained 1 ft. 7 in. of shale and carbonaceous shale as well as much inferior coal. Boreholes N.S. 72 and N.S. 77 revealed similar banded and inferior sections. In borehole No. N.S. 80 the tops showed considerable improvement as compared with N.S. 73 and the ash content over the full thickness of 9 ft. 11 in. (excluding a "badger" 7¾ in. thick) was less than 35 per cent. Because it was not possible to view the complete section of the seam in Moreton Colliery, no precise comparison with the sections in the boreholes can be made, but it is believed that the quality of the seam in Boreholes Nos. N.S. 75 and N.S. 76. would be much the same as in the mine and in borehole No. N.S. 79 rather better.

The Eclipse Seam has been worked extensively in New Ebbw Vale No. 3 Colliery in Woodend Pocket to the south-east of the bored area. As the coal is showing a definite improvement going in that direction it is a safe enough assumption that the seam will be workable in the country in between, a large part of which is occupied by the Railway Workshops Reserve (R. 845).

Judging by the trends indicated by the drilling there appear to be prospects of large reserves of coal to the south of boreholes Nos. N.S. 79 and N.S. 80.

Washability tests carried out on borehole samples of the Eclipse Seam showed that the fraction with specific gravity not greater than 1·8 constituted between 70·5 and 75·5 per cent. of the whole and had an ash content of 18 to 20 per cent. (see Table 3). A reasonably clean coal could be obtained by mining only the middle section of the seam, but in that case large quantities of valuable coal would go to waste.

Francis Seam.—This small seam, which lies some 80 ft. stratigraphically below the Eclipse, was worked to a small extent in the Moreton property. It had a total thickness of 2 ft. with one permanent stone band 1 inch thick and several shale partings. In borehole No. N.S. 75 it was 2 ft. thick and excessively banded. Only one other hole (N.S. 72) was drilled deep enough to intersect it, but there was no coal in the position where the seam was expected, nor for 100 ft. below it.

Faults and Intrusions.

In the Moreton Colliery workings two dip faults and one strike fault have been met with. These are relatively small dislocations which would not be expected to cause any serious loss of coal. At the north-east end of the bored area there is a dip fault of somewhat complex character, accompanied in places by an igneous dyke. However, no workable coal is known to exist here and hence neither the fault nor the intrusion will affect mining operations. There is a small basaltic dyke in Moreton Extended Colliery workings which has caused some coking of the coal, but the loss of coal from this cause would be trifling. The structure contours do not indicate any major faulting within the bored area.

Reserves.

The figures given are for *total* reserves. Actually it is doubtful if much more than half of the coal included in measured reserves will be available for extraction and marketing. In cleaning approximately 20 per cent. will be discarded and, because the greater

TABLE 2.

MORETON—MORETON EXTENDED MINE AREA—TABLE OF ANALYSES.

Sample Reference.	Description of Sample.	Proximate Analysis				Calorific Value.		Sulphur.	Specific Gravity.	Coking Tests.		Fixed Carbon (Dry, M.M.-free basis—Parr Formula).
		Moisture.	Volatile Matter.	Fixed Carbon.	Ash.	Joules/gm.	B.Th.U/lb.			Classification.	Swelling Index	
		Per cent.	Per cent.	Per cent.	Per cent.			Per cent.				Per cent.
				Garden Seam.								
522/55/G.S.	Borehole N.S. 77, 416 ft. 7¼ in.–423 ft. 1¾ in. (Excl. 9¾ in. shale, carb. shale and "bluey" at 420 ft. 8 in.)	2·4	25·7	46·5	25·4	24,780	10,660	0·33	1·483	Cm	5	66·4
21/55/G.S.	Borehole N.S. 77, shale &c. excluded from above ..	..	..	..	72·2	..	..	..	2·129	..	..	..
523/55/G.S.	Borehole N.S. 79, 463 ft. 10½ in.–472 ft. 7 in. (Excl. 2 in. "boulder" at 467 ft. 4½ in., 1½ in. shale and carb. shale at 468 ft. 0½ in., 1 in. "boulder" at 468 ft. 9 in. and 2¾ in. shale at 470 ft. 1 in.)	2·0	28·8	48·7	20·5	26,540	11,420	0·29	1·438	Cm	7	64·3
22/55/G.S.	Borehole N.S. 79, "boulder" excl. from above	..	..	..	59·4	..	..	..	2·734	..	..	..
23/55/G.S.	Borehole N.S. 79, shale and carb. shale excl. from above	..	..	..	79·5	..	..	..	2·339	..	..	..
233/54/G.S.	Borehole N.S. 80, 421 ft. 10¾ in.–430 ft. 0½ in.	2·0	25·5	41·1	31·4	22,530	9,700	0·25	1·612	Cm	5	62·6
				Fiery Seam—Top Section.								
133/54/G.S.	Borehole N.S. 73, 428 ft. 7¼ in.–429 ft. 9½ in.	2·1	22·8	34·9	40·2	19,340	8,320	0·22	1·644	Cw	4	64·9
141/54/G.S.	Borehole N.S. 73, 429 ft. 9½ in.–430 ft. 8½ in.	..	..	..	72·5	..	..	..	2·202	..	..	..
134/54/G.S.	Borehole N.S. 73, 430 ft. 8½ in.–434 ft. 8 in.	1·4	27·3	46·5	24·8	25,600	11,020	0·28	1·473	Cm	7	64·8
139/54/G.S.	Borehole N.S. 75, 202 ft. 10 in.–205 ft. 11½ in.	1·3	24·5	39·7	34·5	21,500	9,250	0·31	1·594	Cm	4½	64·7
136/54/G.S.	Borehole N.S. 76, 520 ft. 8 in.–527 ft. 8½ in. (excl. 3½ in. "boulder" at 521 ft. 10 in.)	1·4	26·1	42·2	30·3	23,550	10,130	0·27	1·532	Cm	5	64·1
145/54/G.S.	Borehole N.S. 76, "boulder" excl. from above	..	..	..	74·7	..	..	..	..	..	..	..
234/54/G.S.	Borehole N.S. 80, 752 ft. 7 in.–762 ft. 10 in.	..	..	..	40·1	..	..	..	1·641	..	..	..
				Fiery Seam—Middle Section.								
143/54/G.S.	Borehole N.S. 76, 527 ft. 8½ in.–535 ft. 1½ in.	..	..	..	43·7	..	..	..	1·702	..	..	..
137/54/G.S.	Borehole N.S. 76, 540 ft. 1 in.–543 ft. 8¾ in.	1·5	23·6	39·1	35·8	21,250	9,140	0·26	1·596	Cm	4	65·4
201/54/G.S.	Borehole N.S. 80, 764 ft. 1¼ in.–766 ft. 9¾ in.	1·5	25·9	47·5	25·1	25,770	11,080	0·29	1·470	Cm	6	66·5
				Fiery Seam—Bottom Section.								
142/54/G.S.	Borehole N.S. 72, 415 ft. 4 in.–416 ft. 10¾ in.	..	..	..	26·6	..	..	..	1·488	..	..	..
138/54/G.S.	Borehole N.S. 72, 419 ft. 4¼ in.–426 ft. 2 in.	1·4	22·9	39·2	36·5	21,280	9,160	0·28	1·596	Cm	3½	66·3
135/54/G.S.	Borehole N.S. 73, 445 ft. 9 in.–453 ft. 6 in. (excl. 2¾ in. "boulder" at 449 ft. 5½ in.)	1·7	24·4	42·5	31·4	23,330	10,040	0·28	1·535	Cm	4½	66·1
144/54/G.S.	Borehole N.S. 73, "boulder" excl. from above	..	..	..	70·1	..	..	..	..	..	..	..
140/54/G.S.	Borehole N.S. 75, 222 ft. 1½ in.–230 ft. 3¾ in. (excl. 2¼ in. "boulder" at 226 ft. 0½ in.)	1·4	24·0	39·4	35·2	21,420	9,220	0·28	1·591	Cm	4½	65·1
146/54/G.S.	Borehole N.S. 75, "boulder" excl. from above	..	..	..	75·7	..	..	..	..	..	..	..
235/54/G.S.	Borehole N.S. 80, 762 ft. 10 in.–764 ft. 1½ in.	..	..	..	55·4	..	..	..	1·878	..	..	..
202/54/G.S.	Borehole N.S. 80, 766 ft. 9¾ in.–768 ft. 3½ in.	..	..	..	65·1	..	..	..	2·030	..	..	..
203/54/G.S.	Borehole N.S. 80, 768 ft. 3½ in.–773 ft. 8¼ in.	..	..	..	40·4	..	..	..	1·651	..	..	..
				Eclipse Seam								
254/55/G.S.	Borehole N.S. 73, 799 ft. 8½ in.–805 ft. 1½ in. (excl. 4¾ in. "badger" at 803 ft. 4 in.)	1·5	26·7	46·4	25·4	25,480	10,960	0·33	1·489	..	..	65·3
116/55/G.S.	"Badger" excl. from above	..	..	..	65·4	..	..	..	2·081	..	..	..
207/54/G.S.	Borehole N.S. 75, 569 ft. 2½ in.–579 ft. 9½ in.	1·4	22·9	40·3	35·4	21,250	9,140	0·27	1·611	Cm	4½	65·2
208/54/G.S.	Borehole N.S. 76, 881 ft. 3½ in.–891 ft. 3½ in.	1·5	22·5	41·5	34·5	21,450	9,230	0·28	1·597	..	..	67·9
209/54/G.S.	Borehole N.S. 79, 1,172 ft. 11½ in.–1,182 ft. 9½ in. ..	1·4	23·6	43·4	31·6	22,920	9,860	0·32	1·558	..	..	67·4
204/54/G.S.	Borehole N.S. 80, 1,114 ft. 5½ in.–1,122 ft. 2½ in.	1·7	22·0	39·8	36·5	21,080	9,070	0·25	1·612	Cm	3½	67·7
205/54/G.S.	Borehole N.S. 80, 1,122 ft. 2½ in.–1,122 ft. 10¼ in. ..	..	..	..	59·8	..	..	..	1·942	..	..	..
206/54/G.S.	Borehole N.S. 80, 1,122 ft. 10¼ in.–1,124 ft. 4½ in. ..	1·4	26·2	49·1	23·3	26,500	11,400	0·32	1·460	..	..	66·9
Coal Board Sample	Moreton Colliery, 29 chains down subsidiary haulage and 3 chains along level to left (thickness 6 ft. 11 in.).	..	..	..	28·8	..	..	..	..	..	..	..

part of the reserves lie under built-up areas (or under the Bremer River), total extraction of the coal would not be permitted.

Garden Seam.—The estimate is based on three boreholes which are practically co-linear. It has been assumed that the seam maintains its quality and thickness for 5 chains on each side of a line joining the three holes and for 5 chains in all directions beyond the two outer holes. This strip has an area of 62·8 acres. The average thickness of the seam is 7 ft. 4 in., average ash is 26·5 per cent. and average specific gravity is 1·495. Measured reserves are estimated at 830,000 tons. It is considered that reserves totalling many times this amount will eventually be found to underlie Basin Pocket and the North Ipswich town area. There is a strong probability also that the seam is of workable quality and thickness in the southern part of R. 845 (Railway Workshops Reserve). Greatest thickness of cover in the bored area is 460 ft.

Fiery Seam, Top Section.—Measured reserves, based on three boreholes, Nos. N.S. 73, N.S. 75 and N.S. 76, are estimated at 620,000 tons. The average thickness is 4 ft. 8½ in., average ash 29·7, and assumed specific gravity 1·53. The seam is estimated to be workable over an area of 70·8 acres. The greatest vertical depth of the seam in this area would not exceed 600 feet.

TABLE 3.

MORETON—MORETON EXTENDED MINE AREA—TABLE OF WASHABILITIES.

Sample Reference (See Table of Analyses).	Ash	Washability Tests on Crushed Samples (−½ in. mesh).							
		Fraction floats at S.G. 1·4.	Ash Content of Fraction.	Fraction floats at S.G. 1·6.	Ash Content of Fraction.	Fraction floats at S.G. 1·8.	Ash Content of Fraction.	Fraction sinks at S.G. 1·8.	Ash Content of Fraction.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
				Garden Seam.					
233/54/G.S.	31·4	49·8	8·3	20·8	21·4	13·0	49·8	16·4	76·3
				Fiery Seam—Top Section.					
133/54/G.S.	40·2	36·3	8·5	33·7	37·5	4·5	46·4	25·5	77·4
134/54/G.S.	24·8	55·3	8·9	27·9	32·3	6·5	48·0	10·3	73·8
139/54/G.S.	34·5	45·8	7·9	23·2	32·6	7·2	48·1	23·8	75·7
136/54/G.S.	30·3	53·7	9·0	25·1	34·7	6·2	48·0	15·0	77·1
234/54/G.S.	40·1	37·3	7·9	18·2	24·8	13·8	50·2	30·7	77·7
				Fiery Seam—Middle Section.					
137/54/G.S.	35·8	43·7	10·1	27·5	33·4	6·2	50·7	22·6	79·9
201/54/G.S.	25·1	47·0	8·8	29·5	24·2	14·4	49·0	9·1	74·8
				Fiery Seam—Bottom Section.					
138/54/G.S.	36·5	39·3	11·8	30·9	34·5	7·3	48·2	22·5	76·2
135/54/G.S.	31·4	42·5	10·1	31·7	30·9	5·5	49·1	20·3	79·4
140/54/G.S.	35·2	45·9	11·2	21·8	33·6	6·3	49·6	26·0	78·0
203/54/G.S.	40·4	33·6	9·2	16·0	23·7	12·6	47·9	38·4	74·4
				Eclipse Seam.					
207/55/G.S.	35·4	38·6	7·1	20·5	24·3	11·4	48·7	29·5	72·1
208/55/G.S.	34·5	40·8	7·5	17·2	24·5	14·6	47·0	27·4	71·8
209/55/G.S.	31·6	41·1	7·7	20·1	24·1	14·3	47·4	24·5	72·1
204/55/G.S.	36·5	40·6	7·0	17·9	23·8	15·2	48·8	26·3	71·4

Fiery Seam, Bottom Section.—There are no reserves with an ash content of 35 per cent. or less. However, as previously stated, it is considered that there will be a substantial tonnage of coal of approximately the same quality as the average coal in Moreton Extended Colliery.

Eclipse Seam.—In the bored area measured reserves are estimated at 2,250,000 tons. In the 139 acres within which the reserves have been estimated the maximum cover will not exceed 1,200 ft. Average seam thickness used in the estimation is 8 ft. 8in. (in practice it is expected to be rather more) and average ash is 32·6 per cent. Mean specific gravity is 1·56.

It is expected that large additional reserves will be found to the south of boreholes Nos. N.S. 79 and N.S. 80. It is also estimated that approximately 2 million tons underlie the Railway Workshops Reserve (R. 845), where the cover will vary from approximately 250 ft. at the northern end to 900 ft. at the southern end.

Conclusions.

The results of the drilling of the Moreton—Moreton Extended area must on the whole be regarded as decidedly disappointing. Of the six main seams of the North Ipswich mining district that were tested only three had any workable coal and in the north-eastern end of the area not one of the seams tested was workable. The most attractive seam from the point of view of reserves, both proved and prospective, and seam thickness is the Eclipse, but the Garden Seam shows great promise and should be further tested before the underlying coal is extracted. The Fiery Seam did not come up to expectations but nevertheless it has useful reserves.

All the coal is dirty and will require beneficiation before being marketed. Washability tests carried out on core samples suggest that a reasonably good grade of coal could be obtained by discarding the plus 1·8 specific gravity fraction, usually amounting to between one-fifth and one-quarter of the material treated.

Total measured reserves of coal in three seams are estimated at 3,700,000 tons of which about one-half is expected to be available for marketing. In addition, there are estimated to be over 2,000,000 tons under the Railway Workshops Reserve, and there are prospects of large tonnages in two seams south of the bored area.

A. K. Denmead,

Chief Government Geologist.

26th July, 1957.

APPENDIX.

MORETON EXTENDED COLLIERY.

Introduction.

Accompanied by members of the Coal Board the writer made an inspection of Moreton Extended Colliery by 28th April.

The quality of the coal being mined had deteriorated markedly during the later stages of development of the mine and the inspection was made to determine the future prospects of the colliery and to formulate a general picture of the variations of the Fiery Seam in the locality.

On 30th April, accompanied by Mr. D. A. Davies, Assistant Geologist, the writer revisited Moreton Extended and had two channel samples Nos. 1 and 2 cut at the positions shown on the accompanying mine plan (figure 1). Sample No. 1 was taken at a place which was suggested by Mr. I. Evans, a member of the Coal Board, as being representative of the Fiery Seam as exposed in that part of the mine developed recently. It is the writer's opinion that no one sample can be truly representative of the seam in this area.

In addition, sections of the seam were measured throughout the mine to show the variability of the Fiery Seam in this area. Sections 1-7 inclusive were measured by the writer while additional sections measured by Mr. A. J. Norman, fuel technologist to the Coal Board, were made available for the report.

The Fiery Seam.

During the initial development of the mine the lower part of the Fiery Seam which was the only part of the seam worked in the colliery remained regular as can be seen in the main dip down to the main level, a distance of 11 chains and then along the main level to the vicinity of a basalt dyke which strikes approximately north-west and which cuts the main level 3¼ chains from its initial point. Section 2 is a representative section of the seam measured in the main level to the east of the dyke. The bottom coal ply was not exposed but the mine manager reported 1 ft. 0 in. of coal here. The total section exposed measured 6 ft. 6½ in. with 14½ in. shale and sandstone, 3 in. bluey, 4 in. inferior coal and 57 in. coal.

Five coal plies A-E are distinguishable in the Fiery Seam and these are separated by four stone bands I-IV (see Fig. 1).

The coal plies of section 2, which is representative of the undisturbed seam, are used as a basis for comparison with the remaining sections. An attempt will now be made to explain the variations in the seam as shown by the sections in figure 1 taking each coal ply as an individual depositional unit.

Ply A shows irregularity of the roof indicating slight unevenness of the final coal forming surface due possibly to slight erosion but more likely to be caused by an uneven thickness of original coal-forming material which when compressed gave a variable thickness of coal.

The first stone band (I) of any magnitude which was encountered is of constant thickness of 1½ in. in each section. The coal in ply A has deteriorated in sections 1, 3, 4 and 6 compared with section 2. The deterioration would not be sufficient to necessitate exclusion of this ply from the mined coal with the exception of ply A in section 6.

Coal ply B which measured 1 ft. 5½ in. coal in section 2 deteriorated progressively through sections 3, 4, 5, 6 and 7 until in section 1 it is reduced to 6½ in. coal, 3½ in. inferior coal and 2 in. bluey. The thinning of this coal ply in section 1 is explained by the occurrence of an 11 in. sandstone-shale lens (II) under the ply. In most of the sections this stone band was only 3 in. thick hence a thinning of the coal above the arenaceous lens as well as a deterioration in the quality of the coal would be expected.

Coal ply C averages 1 ft. 10½ in. coal in sections 1-5 inclusive with some inferior coal replacing coal in section 4. In section 6 a stone band composed of 9½ in. fine sandstone and 4 in. siltstone (III) has been deposited in a contemporaneous erosion channel in the coal and has replaced the bottom 4 in. of the coal from the ply. The inferior coal and bluey overlying the sandy lens indicate that there was still a shallow stream channel at this point with only slight current movement, sufficient to wash very fine sediment into the coal forming fauna growing in the sluggish waters.

Underlying coal ply C in section 4 the shale band (III) which averages 4 in. in width over most of the area has grown to 19 in. indicating that a stream channel once occupied this position. Coal ply C is only slightly thinned in this section so by the time this ply began to accumulate there must have been a reversion to almost stagnant conditions. The underlying coal ply D has been reduced to a thickness of 11 in. from an average thickness of 14½ in. elsewhere in the mine, i.e., there was erosion into the top of the underlying coal ply D by the stream whose channel was later filled with the fine sediment now represented by the shale lens.

Coal ply D was slightly thinned above the shale band (IV) between plies D and E in section 5 where the shale band has grown from an average 4 in. to 10 in.

Coal ply E averages 10 in. but could not be measured in all sections. From those sections in which it was measured it averaged 4 in. coal and 6 in. bluey.

Section 7 must be regarded as a special case with complete erosion of ply D and pronounced thinning of the overlying coal ply C due to much more vigorous stream action than has been encountered elsewhere in the area.

Summary.

The Fiery seam in this particular area was accumulated in a swamp which was subjected to rapid variations of the courses of numerous minor waterways which flowed across it.

Five definite coal plies with four intervening stone bands formed the worked section of the seam. Of these stone bands only the uppermost one, band (I) showed any degree of constancy.

Conclusion.

Diamond drilling in the vicinity of Moreton Extended has shown the Fiery Seam to be irregular and in view of this it must be assumed that disturbed conditions such as described above will be encountered with further development of the mine. When any one of the stone bands begins to thicken it can be anticipated that the coal ply immediately above the band will be thinned and the coal therein will be inferior. If the stone band grows to 12 in. or greater the underlying coal ply will be eroded to a degree depending on the thickness of the stone band.

There is a possibility that a stream pattern could be worked out for that area of the colliery already developed but this would entail cleaning down faces and measuring sections in many more places than has been done. Such work is not warranted in this case.

From the sections measured a very tentative stream pattern may be traced to show a general direction of flow of 015°. Working on this assumption there should be a block of undisturbed coal immediately to the south of the main level (see shaded area on mine plan, fig. 1). The meandering nature of the expected stream courses made it impossible to determine the extent of this block. At the same time the area to the south-east of the present dip face could be investigated.

Attached to the report is table "A" summarising the thickness of each coal ply as measured in the sections drawn, together with three sections measured by Mr. Norman. In two of these three latter sections the coal plies have been analysed individually. They averaged 24·3 per cent. ash. The complete sections were also analysed and they averaged 35 per cent. ash.

The writer took two samples during his inspections. Sample No. 1 was taken at the position of Section 1 and it contained 42 per cent. ash. No stone bands were excluded. Band IV and coal ply E could not be incorporated in the sample. The second sample was taken at the working face in the main level, i.e., 11 chains down the tunnel and approximately 7½ chains to the right. This sample contained 35 per cent. ash.

B. W. Hawkins,
Assistant Geologist.

24th June, 1954.

TABLE A—MORETON EXTENDED.

Coal Ply.	Section 2.		Section 1.		Section 3.		Section 4.		Section 5.	
	Width.	Percentage of Coal.	Width.	Percentage of Coal.	Width.	Percentage of Coal.	Width.	Percentage of Coal.	Width.	Percentage of Coal.
A	13 in.	80 coal 20 inferior	15 in.	Mainly inferior	10 in.	40 coal 60 inferior	11½ in.	100 inferior	14½ in.	85 coal 15 inferior
B	16 in.	90 coal 10 inferior	12 in.	50 coal 50 inferior	15½ in.	80 coal 20 inferior	17 in.	85 coal 15 inferior	15¾ in.	65 coal 35 inferior
C	21 in.	95 coal 5 inferior	20¼ in.	95 coal 5 inferior	23½ in.	90 coal 10 inferior	21 in.	60 coal 40 inferior	21½ in.	80 coal 20 inferior
D	15 in.	90 coal 10 inferior	14⅜ in.	95 coal 5 inferior	14½ in.	65 coal 35 inferior	11 in.	95 coal 5 inferior	12 in.	90 coal 10 inferior
E	12 in.?	? reported coal	12 in.?	? reported coal	9½ in.	55 coal 45 inferior	10 in.	40 coal 60 inferior	8 in.	50 coal 50 inferior

Coal Ply.	Section 6.		Section 7.		Section 8.		Section 9.		Section 10.	
	Width.	Percentage of Coal.	Width.	Percentage of Coal.	Width.	Percentage of Ash.	Width.	Percentage of Ash.	Width.	Percentage of Coal.
A	13 in.	20 coal 80 inferior	13½ in.	80 coal 20 inferior	13½ in.	27	14½ in.	25·4	15 in.	60 coal 40 inferior
B	15¼ in.	70 coal 30 inferior	11 in.	Inferior	15 in.	20·6	15½ in.	18·1	11½ in.	Inferior
C	16 in.	30 coal 70 inferior	9½ in.	55 coal 45 inferior	22 in.	29	22½ in.	26·4	25½ in.	Coal
D	11 in.	60 coal 40 inferior	Nil	Nil	12 in.	17	12 in.	19	15½ in.	40 coal 60 inferior
E	11 in.	45 coal 55 inferior	8 in.	60 coal 40 inferior	11 in.	28	10½ in.	30·9	13 in.	40 coal 60 inferior
			Total Section		86 in.	33·8	92½ in.	35·6		

Inferior includes—inferior coal.
bluey.
shale.
sandstone.

A. H. Tucker, Government Printer, Brisbane.

DEPARTMENT OF MINES, QUEENSLAND

GEOLOGICAL MAP

ROTHWELL HAIGH MINE AREA

IPSWICH COALFIELD

Parish of Chuwar

County of Stanley

Warden's District of Ipswich

Showing

Geology, Topography & boreholes

To accompany report by A.K.Denmead M.Sc.

Surface mapping by J.O.Cuthbert & B.W.Hawkins B's.Sc.

Topographic Survey by E.Cowley

Scale of Chains

5 4 3 2 1 10 5 10 15 20

Grid of 20chn. co-ordinates. Meridian of grid is True North at origin, an arbitrary point, being bolt in concrete block on road near angle in Eastern boundary of Sub.1, Por.213, Parish of Ipswich. Elevations on State Datum.

LEGEND

Established geological boundary - position accurate		
- position approx.		
Inferred, probable or indefinite boundary		
Established fault - position accurate		
- position approx.		
- concealed		
Inferred, probable or indefinite fault		
Inferred, probable or indefinite fault, concealed		
High angle fault	Colliery (Working)	HAIGHMOOR
Ipswich Coal Measures	Colliery (Abandoned)	NOBLEVALE A
Alluvium	Adit	ADIT
Coal Seam at Surface	Shaft	
Outcrop	Diamond Drillhole	⊙N.S.61
Strike & dip of strata	Percussion Drillhole	○Bore 11(P)
Strike & dip of joints	Surface Contours	60

18000 W 16000 W 14000 W 12000 W 10000 W

38000 N 36000 N 34000 N

ROTHWELL HAIGH EXTD. SEAM · BENLEY SEAM · BENLEY Coal · ECLIPSE SEAM · SOUND TUNNEL · GLENCOE A · ROTHWELL HAIGH No.3 A · ROTHWELL HAIGH No.1 A · HORSE TUNNEL · ROTHWELL HAIGH No.5 A · ROTHWELL HAIGH No.2 A · ROTHWELL HAIGH No.6 · ROTHWELL HAIGH No.4 A · OLD TUNNEL · TIVOLI SEAM · WATERSTOWN SEAM · FIERY SEAM · ECHO TUNNEL A · NEW ECLIPSE A · RYLANCE ABERMAIN No.2 · ABERMAIN A · EDINA TUNNEL A · FRANCIS SEAM · GUILAND · POVERTY BRANCH · CHEFFERNAN · GREASLEY · CROSBY SEAM · BOTTOM SEAM · TOP SEAM · BLACK SEAM · FAULT · RLY

⊙N.S.68 RL Col. 122·65 RL Surf. 119·35 RL Btm. -282·27

⊙N.S.74 RL Col. 155·95 RL Surf. 154·70 RL Btm. -22·05

⊙N.S.71 RL Col. 168·95 RL Surf. 167·66 RL Btm. -270·05

⊙N.S.70 RL Col. 158·20 RL Surf. 154·38 RL Btm. -514·47

⊙N.S.69 RL Col. 175·30 RL Surf. 172·79 RL Btm. -581·03

⊙N.S.60 RL Col. 45·90 RL Surf. 44·40 RL Btm. -674·10

R.1484 Sewerage Res.

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

ROTHWELL HAIGH MINE AREA
IPSWICH COALFIELD
Parish of Chuwar
County of Stanley
Warden's District of Ipswich

Showing boreholes, mine workings and boundary of measured reserves.

To accompany report by A.K.Denmead Asst. Chief Govt. Geologist.
Survey by E.Cowley.

Scale of Chains

5 0 5 10 15 20

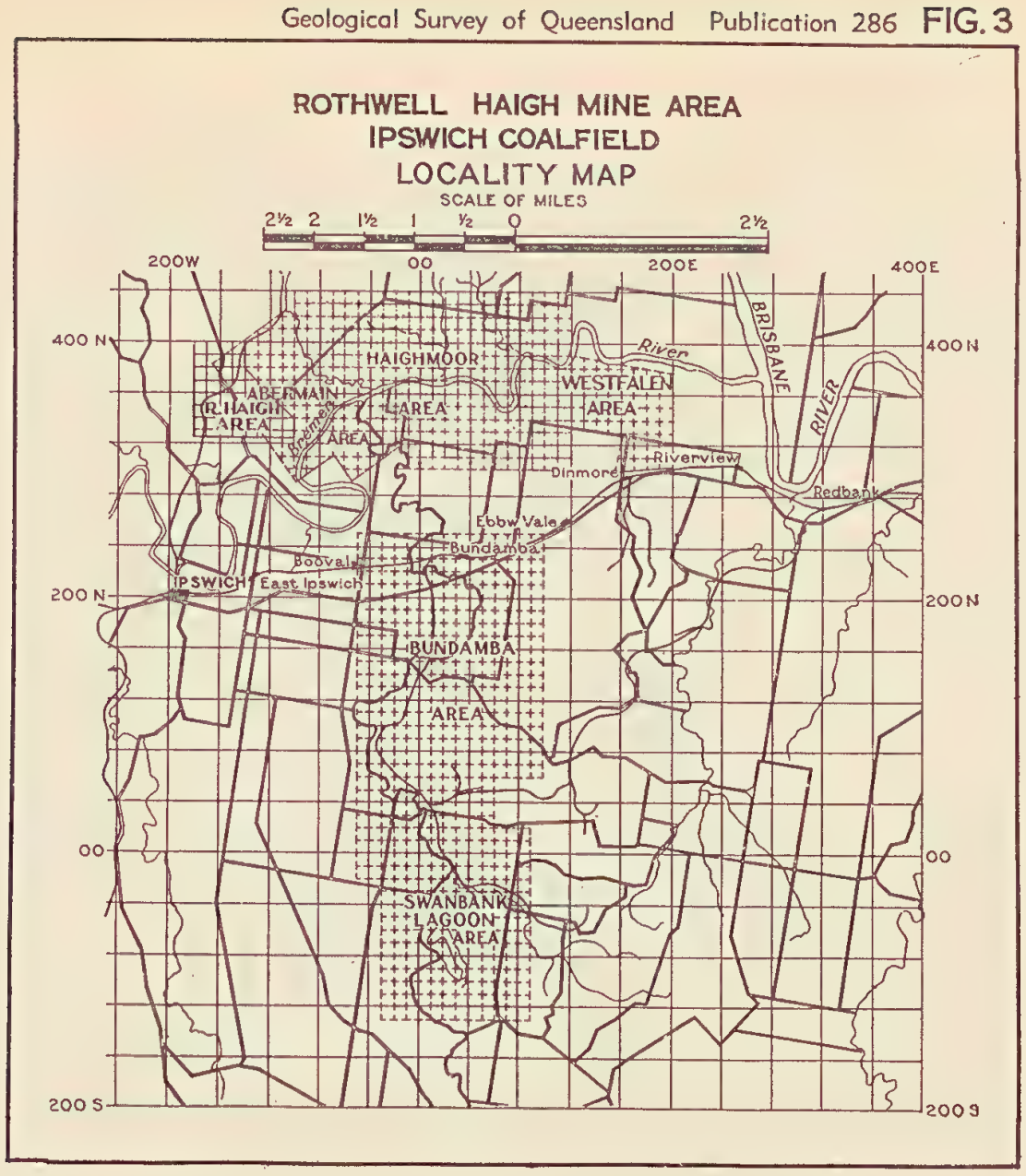
Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of Sub.1, Por. 213, Parish of Ipswich. Elevations on State Datum. Grid of 20 Chn. co-ordinates.

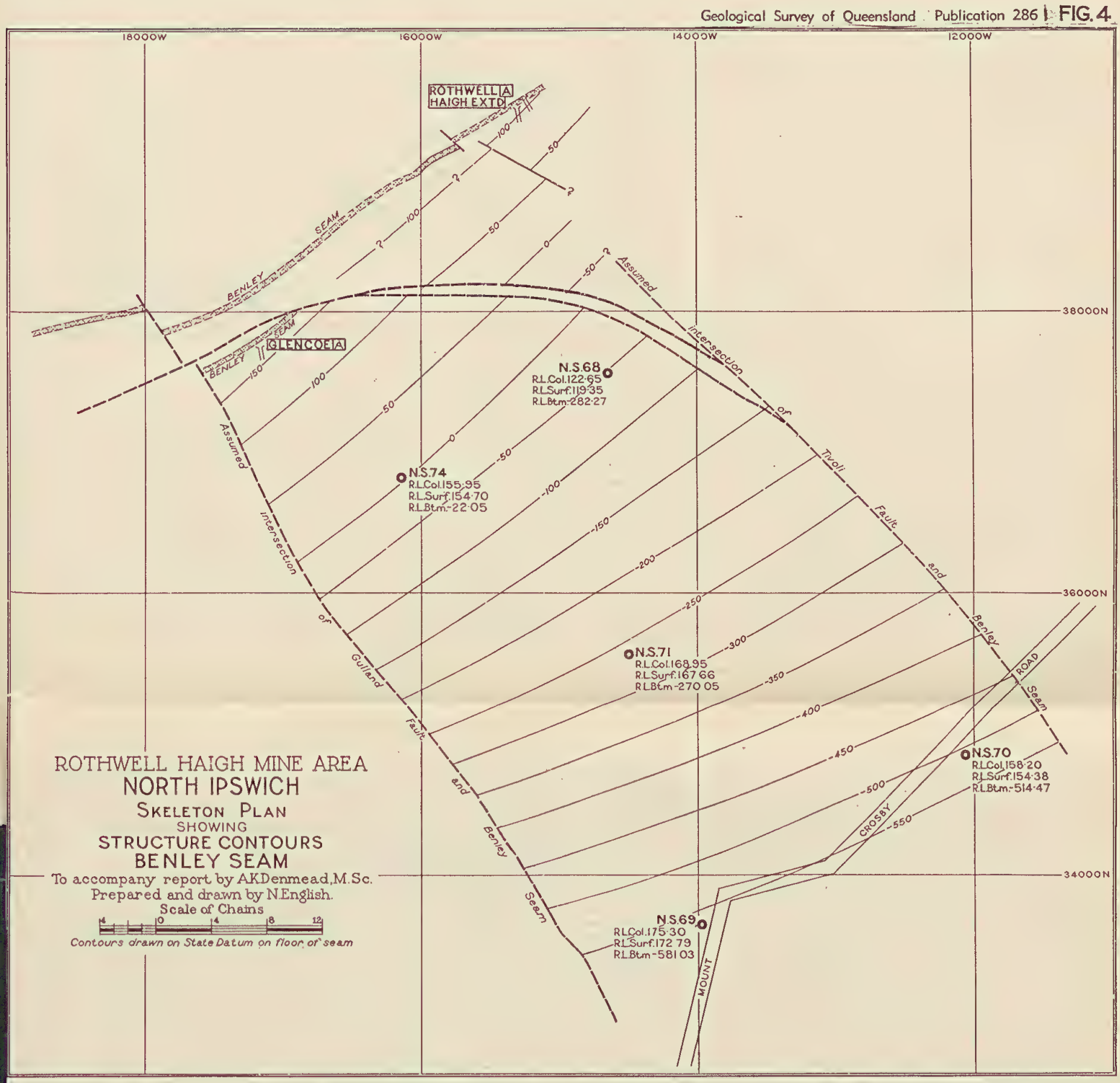
LEGEND

Colliery (Working). NEATH Borehole. ◎ N.S.1
Colliery (Abandoned) NEATH A Seam section measured. ⊕ A
Shaft. Adit.
Fault. – – – – Cross section line. X——X'
Elevations taken from mine plans & adj. to State Datum. o 247'
Boundary of measured reserves on Benley seam. .....
Limit of mine workings :- Benley Seam ------ Eclipse Seam ---- Waterstown Seam ---- Tivoli Seam .....
Tantivy Seam ------. Seam outcrop ===.

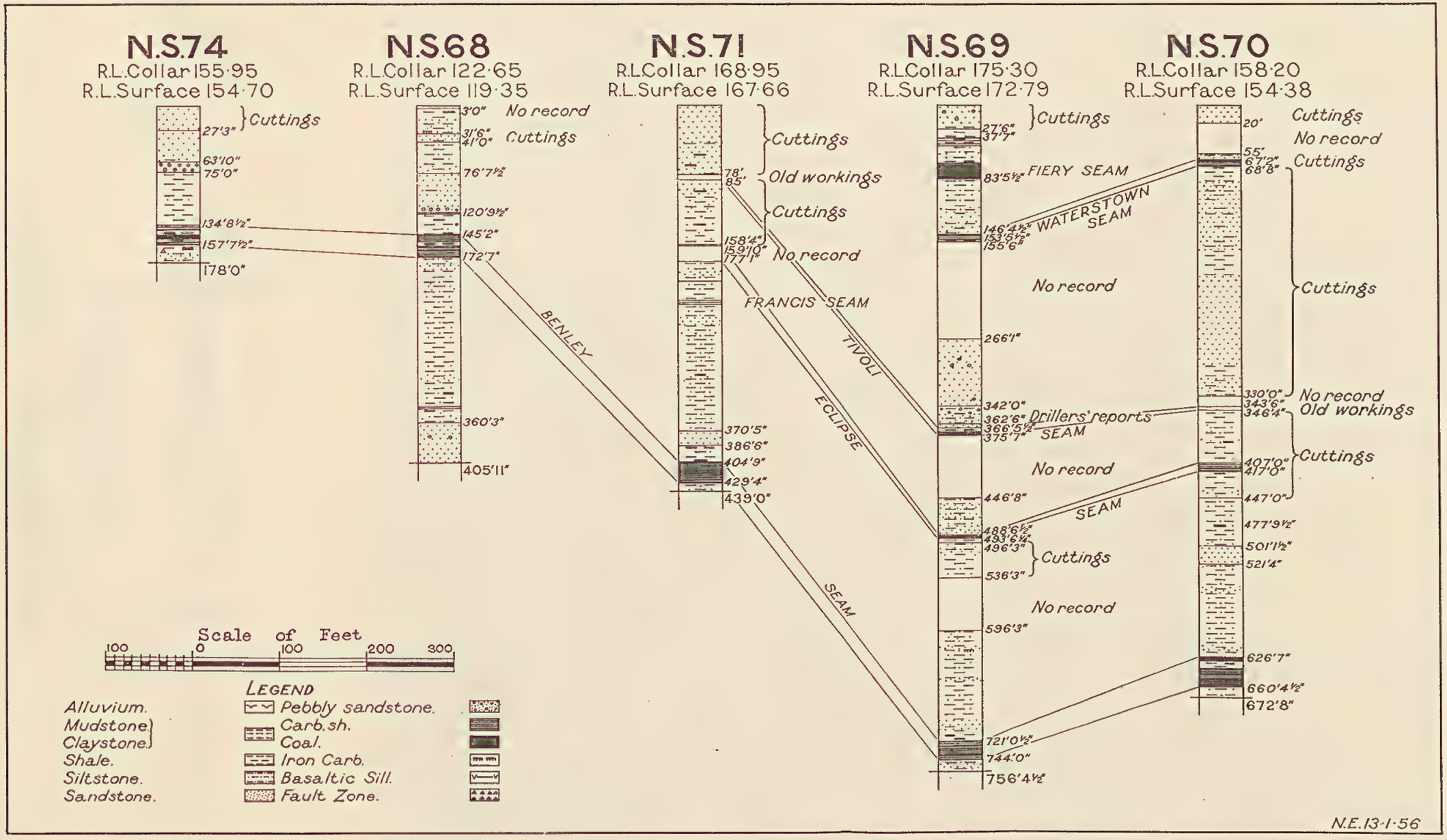
V.B.Beikoff del.

ROTHWELL A HAIGH EXT D
B
RAILWAY
FRANCIS
RD.
SEAM
BENLEY
131
068'
047'
025'
B.S.1
064'
A
38000 N
GLENCOE A
SEAM
BENLEY
HOLDSWORTH
69
SOUND A TUNNEL
N.S.68
R.L.Col.122·65
R.L.Surf.119·35
R.L.Btm.-282·27
ROTHWELL A HAIGH No.3
WARE ST.
ROBERTS ST.
KAY ST.
70
N.S.74
R.L.Col.155·95
R.L.Surf.154·70
R.L.Btm.-22·05
BRANCH
ST.
FRANCIS
ROTHWELL HAIGH No.1 A
HORSE TUNNEL
68
OLD TUNNEL
ROTHWELL HAIGH No.5 A
36000 N.
ROTHWELL HAIGH No.2 A
MURRAY ST.
BOTHWICK ST.
ALLEN ST.
TIVOLI
ST.
ROTHWELL HAIGH No.6
N.S.71
R.L.Col.168·95
R.L.Surf.167·66
R.L.Btm.-270·05
67
To Mt. Crosby
42
ROTHWELL A HAIGH No.4
71
ROAD
N.S.70
R.L.Col.158·20
R.L.Surf.154·38
R.L.Btm.-514·47
B'
ECHO A TUNNEL
To Ipswich
72
MT. CROSBY
43
ST.
34000 N
GREASLEY
N.S.69
R.L.Col.175·30
R.L.Surf.172·79
R.L.Btm.-581·03
A'
74
78
BLACK ST.
Bore (P) o
R.L.Surf.81·75
CROYDON
RYLANCE ABERMAIN No.2
ABERMAIN A (Waterstown)
HARRIS
EDINA A TUNNEL
73
ROAD
18000 W
16000 W
14000 W
12000 W


ROTHWELL HAIGH MINE AREA
IPSWICH COALFIELD
LOCALITY MAP
SCALE OF MILES
2½ 2 1½ 1 ½ 0 2½
200W
00
200E
400E
400 N
200 N
00
200 S
HAIGHMOOR AREA
WESTFALEN AREA
ABERMAIN HAIGH AREA
BUNDAMBA AREA
SWANBANK LAGOON AREA
Bremer River
BRISBANE RIVER
Riverview
Dinmore
Redbank
Ebbw Vale
Bundamba
Booval
IPSWICH
East Ipswich


18000W
16000W
14000W
12000W
38000N
36000N
34000N
ROTHWELL A HAIGH EXTD
GLENCOE A
BENLEY SEAM
Assumed intersection of Gulland Fault and Benley Seam
Assumed intersection of Tivoli Fault and Benley Seam
CROSBY ROAD Seam
MOUNT
N.S.68
R.L.Col.122·65
R.L.Surf.119·35
R.L.Btm.-282·27
N.S.74
R.L.Col.155·95
R.L.Surf.154·70
R.L.Btm.-22·05
N.S.71
R.L.Col.168·95
R.L.Surf.167·66
R.L.Btm.-270·05
N.S.70
R.L.Col.158·20
R.L.Surf.154·38
R.L.Btm.-514·47
N.S.69
R.L.Col.175·30
R.L.Surf.172·79
R.L.Btm.-581·03
100
50
0
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
-550
ROTHWELL HAIGH MINE AREA
NORTH IPSWICH
SKELETON PLAN
SHOWING
STRUCTURE CONTOURS
BENLEY SEAM
To accompany report by A.K.Denmead, M.Sc.
Prepared and drawn by N.English.
Scale of Chains
4 0 4 8 12
Contours drawn on State Datum on floor of seam

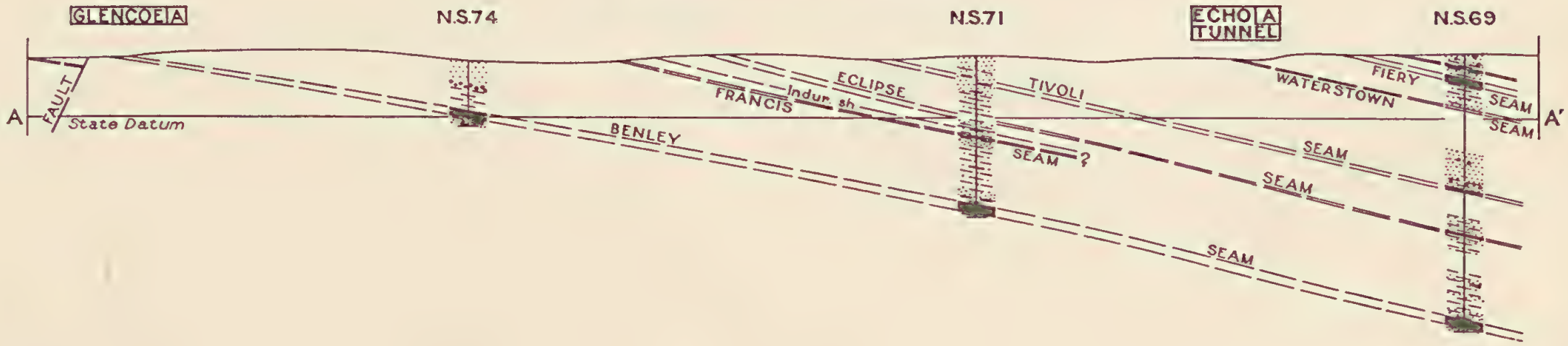
ROTHWELL HAIGH MINE AREA GENERALISED BORE LOGS. Geological Survey of Queensland Publication 286 FIG. 5

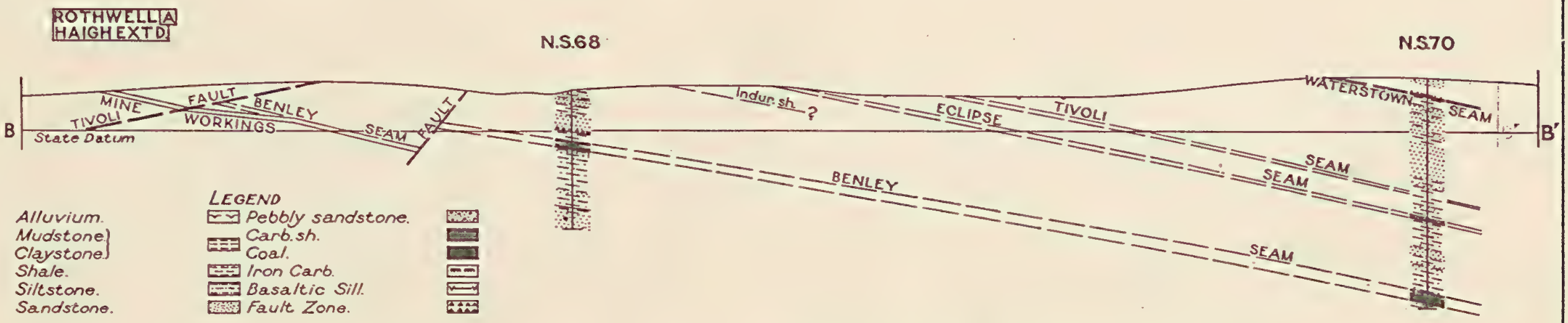


ROTHWELL HAIGH
CROSS SECTIONS

Scale of Chains

4 2 0 4 8 12





LEGEND

Alluvium.	Pebbly sandstone.	
Mudstone. Claystone.	Carb. sh.	
	Coal.	
Shale.	Iron Carb.	
Siltstone.	Basaltic Sill.	
Sandstone.	Fault Zone.	

N.E. 13-1-56

ROTHWELL HAIGH MINE AREA — DETAILS OF CORE RECOVERY AND ANALYSES — DIAGRAMS OF BENLEY SEAM

Geological Survey of Queensland Publication 286 **FIG. 7**

N.S.68

Prox. Analysis S., Cal. Val. & S.G.	per cent.	sampled	Description
			158′ 0¾″ — 4″ Bluey ½″ fn. Sh. (b.c.) 1″ Inf. Coal & Bluey ¼″ fn. Sh. 1″ Coal ½″ Carb. Sh. ¾″ fn. Sh. (b.c.) 1½″ Coal & Inf. Coal (b.c.) 2″ Bluey ½″ Coal 3″ Bluey c Coal lents. from 2″ to 2½′ from top.
M.%	1·3		160′ 5¾″ — 1½″ Coal & Inf. Coal ½″ Bluey ½″ fn. Sh. 1¾″ Bluey 1¼″ Coal 1½″ Coal (p.b.c.) 9¼″ Bluey & Inf. Coal c few bands of Coal ¼″ fn. Sh. 2¼″ Bluey & Coal ¼″ d. gy. Sh. 1″ Coal 1″ Bluey 1″ Coal ¼″ Carb. Sh. ¾″ fn. Sh. (p.b.c.) ½″ Carb. Sh. c Coal lents. ½″ d. fn. Sh. 2¾″ Bluey
V.M.%	21·5		161′ 1¼″ — 1″ Carb. Sh. 1¼″ fn. Sh. ¼″ Carb. Sh. ¼″ fn. Sh. 2″ Coal & Inf. Coal 2″ Bluey 3¼″ Coal ¼″ Carb. Sh. 3¼″ Coal 2″ Coal ¼″ Carb. Sh. ¾″ Coal ½″ d. fn. Sh. 6¾″ Bluey → Inf. Coal → Coal 3¼″ Coal 2″ Coal & Bluey 2″ Bluey 1½″ Coal ¾″ Coal 4″ Carb. Sh. c Coal lents.
F.C.%	47·6		
A.%	29·6		
S.%	0·38		
Joules/Gm.	23480		
B.T.U./lb.	10100	100 Excluded	
S.G.	1·555		
Coking Tests			
Classification	Cw		
Swelling Index	3½		
M.%	1·1		167′ 2½″ — 6″ fn. Sh. 2½″ Carb. Sh. 1¾″ Coal & Inf. Coal 1″ Carb. Sh. 1″ fn. Sh. 5¼″ fn. Sh. 1¼″ Carb. Sh. 7¼″ fn. Slts. → Sh.
V.M.%	20·9		168′ 7½″ — ½″ d. gy. Sh. 6½″ Carb. Sh. 5″ Carb. Sh. c Coal lents. ¾″
F.C.%	49·2		169′ 4¼″ — d. gy. Sh. 2″ Carb. Sh. c Coal lents. 1¼″ Coal ¾″ Bluey ½″ Coal ¼″ Carb. Sh. ½″ Coal. 7½″ Bluey c ¼″ Coal bands.
A.%	28·8		171′ 4½″ — 2½″ Coal ½″ Bluey ½″ Coal ¾″ Bluey 1″ d. gy. Sh. ¼″ fn. Sh. 1½″ Carb. Sh. c two ⅛″ fn. Sh. bands 6″ Carb. Sh. c Coal lam. 1¼″ Coal & Inf. Coal 1¾″ Coal 5″ Bluey (b.c.) 4″ Coal (b.c.) 6″ Bluey 1¾″ Coal 4½″ Coal ½″ fn. Sh. 2¼″ Carb. Sh.
S.%	0·35		
Joules/Gm.	24400		
B.T.U./lb.	10500	100 Excluded	
S.G.	1·523		
Coking Tests			
Classification	Cw-Cm		
Swelling Index	5		

Overall Recovery 100%
158′ 0¾″ to 171′ 4½″

N.S.69

Prox. Analysis S., Cal. Val. & S.G.	per cent.	sampled	Description
			734′ 5″ — 8″ Bluey & Coal lents. 2″ fn. Sh. 1″ fn. Sh. 1″ Carb. Sh. c Coal lents. 4½″ Bluey & fn. Sh. Bands. 5″ Coal & Inf. Coal ½″ fn. Sh.
M.%	1·1		736′ 1½″ — 10½″ Coal & Carb. Sh. (b.c.)
V.M.%	20·0		736′ 5½″ — ½″ med. gy. Sh. 2″ Bluey 1½″ fn. Sh. c Coal lents.
F.C.%	48·6		1′6″ Coal c Carb. Sh. lents. (b.c.)
A.%	30·3		
S.%	0·27	Excluded	
Joules/Gm.	23830		
B.T.U./lb.	10260	100	
S.G.	1·547		
Coking Tests			
Classification	Cw		7″ Bluey. 4½″ Coal & Bluey.
Swelling Index	3½		739′ 3½″ — 4½″ Coal c Bluey lents. (b.c.) 2″ Carb. Sh. 4″ Buff Sh. c carb. 1½″ Sh. Arenite 4½″ Bluey lents. ¾″ fn. Sh. c Coal c Coal lents. lents. ¾″ Coal 3″ Coal c Bluey lents. 2½″ Inf. Coal (b.c.) 1″ Carb. Sh. 1½″ Sh. Arenite 4½″ Buff Sh. c Carb. Sh. lenses. 1″ Sh. Arenite. 1″ Carb. Sh. 5″ Coal & Bluey 2″ Coal. 3″ fn. & Carb. Sh. c Inf. Coal 5½″ Coal. 2½″ Carb. Sh. c fn. Sh. lents. 3″ Carb. Sh. c Coal lents. 6″ Coal, Carb. Sh. & fn. Sh. 1½″ Coal c 3″ Carb. Sh. Carb. Sh. lents.
			1′0″ wh. Sh.
			2′1½″ wh. f. Ss.

Overall Recovery 100%
734′ 5″ to 747′ 4½″

N.S.70

Prox. Analysis S., Cal. Val. & S.G.	per cent.	sampled	Description
M.%	1·0		653′ 3″ — ¾″ fn. Sh. ¾″ Bluey 1¼″ Buff Sh. 5½″ Bluey (p.b.c.) 2¼″ Carb. Sh. (b.c.) 2″ Coal c Carb. Sh. partings ½″ med. gy. Sh
V.M.%	20·2		1′3″ Coal & Inf. Coal (p.b.c.)
F.C.%	47·1		655′ 3¼″ — 2½″ med. gy. Sh. c ¼″ Inf. Coal 2″
A.%	31·7		655′ 8¼″ — Bluey 1″ l. → med. gy. Sh.
S.%	0·23		10¼″ Coal & Inf. Coal (b.c.) (b.c.)
Joules/Gm.	23250	100	½″ fn. Sh. 4½″ Bluey c Coal lents.
B.T.U./lb.	10000	Excluded	657′ 7″ — 6½″ Coal.
S.G.	1·567		10½″ Bluey c 1″ Carb. Sh. 5″ from top
Coking Tests			3½″ fn. Sh.
Classification	Cw		11½″ Bluey.
Swelling Index	3½		8″ fn. Slts. → Sh.
			in btm. 9½″
			1′2¼″ Bluey c thin Inf. Coal bands
			1½″ Coal. top.
			5¼″ Bluey c ½″ d. gy. Sh. 3½″ from
			3″ Carb. Sh. 2″ Inf. Coal → Coal.
			1½″ Carb. Slts. 2″ gy. w. Slts.
			1′9″ l. gy. Slts.

Overall Recovery 100%
653′ 3″ to 664′ 7″

N.S.71

Prox. Analysis S., Cal. Val. & S.G.	per cent.	sampled	Description
			414′ 3¼″ — 2″ Bluey ¾″ Coal 1½″ Inf. Coal c fn. Sh. lam. 1½″ fn. Sh. (p.b.c.) 1¾″ Inf. Coal ½″ med. gy. Sh. 9½″ Coal & Inf. Coal 1″ fn. Sh. 2″ Inf. Coal & Coal ½″ Carb. Sh. 2″ Coal & Inf.
A.%	51·0	100	416′ 3½″ — Coal 1″ Carb. Sh. 6″ Coal & Inf. Coal 3″ Sh. Arenite 1″ d. gy. Sh. ¼″ Coal ½″ Sh.
A.%	71·5	100	417′ 8¼″ — Arenite 4″ Inf. Coal c Carb. Sh. lam. 1″ fn. Sh. 1″ Carb. Sh. 1″ Coal & Carb. Sh. lam. ½″ fn. Sh. c Carb. lents. ¼″ Carb. Sh. c Coal lents. ¼″ Carb. Sh. 2″ l. gy. Sh. c Carb. Sh. lents. 2″ Carb. Sh. c Coal lents.
A.%	26·5		4″ Coal c Carb. Sh. lents.
S.G.	1·528	97·1	420′ 10½″ — ¼″ fn. Sh. 7½″ Coal & Inf. Coal c ½″ fn. Sh. at 5″ & 7″
See table 1 for Washability Tests			1½″ Coal ½″ fn. Sh. 1′0½″ Coal 3″ Bluey 9″ Coal (p.b.c.) 10″ fn. f. Ss. 1″ Carb. Sh. (p.b.c.) 5″ l. gy. Sh. 6″ Carb. Sh. 1″ l. gy. Sh. 4½″ Inf. Coal 1″ Coal 1¼″ Inf. Coal ¾″ med. gy. Slts. 5¾″
		Excluded	l. gy. Sh. 3″ Inf. Coal ½″
			424′ 4¼″ — Coal 1½″ Carb. Sh. ½″ Inf. Coal 3″ Coal ½″ Carb. Sh. ½″ Inf. Coal 1½″ Coal & Inf. Coal 2″ Inf. Coal & Coal 2½″ Coal ½″ l. gy. Sh. c Carb. lents. ¾″ Coal ½″ Carb. Sh. ½″ Coal 2½″
A.%	36·4	100	427′ 1½″ — Inf. Coal 4½″ Coal & Inf. Coal (b.c.) ½″ med. gy. Sh. 2″ Inf. Coal 6″ Coal & Inf. Coal (p.b.c.) 1″ Coal & Carb. Sh. 2″ Carb. Sh. 2½″ Coal 1″ Bluey ¾″ l. gy. Sh. ¼″ Inf. Coal.

Overall Recovery 98·1%
414′ 3¼″ to 427′ 1½″

N.S.74

Prox. Analysis S., Cal. Val. & S.G.	per cent.	sampled	Description
			146′ 6½″ — ½″ Brn. Sh. 1½″ Carb. Sh. c thin Inf. Coal bands 1″ fn. Sh. c Carb. lents. 5½″ Carb. Sh. & Coal lam. (p.b.c.) ½″ Bluey ½″ d. gy. Sh. 1″ Carb. Sh. (b.c.) 2½″ Carb. Sh. (60%) & Inf. Coal 1″ Carb. Sh. 1½″ Inf. Coal.
A.%	31·6		3′8″ Coal & Inf. Coal c approx. six ½″ bands of Carb. Sh. throughout.
S.G.	1·577	89·3	
See table 1 for Washability Tests			151′ 7½″ — 4½″ Bluey. 1″ Carb. Sh. 2″ fn. Sh. ½″ Carb. Sh. ½″ fn. Sh. ½″ Carb. Sh. ½″ fn. Sh. 8″ Carb. Sh. c Coal lents.
			153′ 2″ — 5″ fn. Sh. 4¾″ Carb. Sh.
A.%	44·0	100	154′ 2″ — 5½″ Carb. Sh. c ¼″ Coal bands. 1¼″ Carb. Sh. ½″ Inf. Coal ½″ d. fn. Sh. 2″ Bluey.
			1′2¼″ Coal & Inf. Coal c two ¼″ Sh. bands 8 & 9″ from top.
A.%	32·2	Excluded 100	155′ 6¼″ — 1″ Carb. Sh. 1¼″ d. fn. Sh. 1½″ Carb.
S.G.	1·578		155′ 9¼″ — Sh. c ¼″ Coal ¼″ fn. Sh.
See table 1 for Washability Tests			10¼″ Inf. Coal & Coal 1″ Carb. Sh. 6½″ Inf. Coal (b.c.)
			157′ 7½″ — ½″ d. gy. Sh. 4″ Coal & Inf. Coal. 6″ Boulder. 2″ Carb. Sh. c Coal lents. 8½″ dk. gy. Sh.

Overall Recovery 94·4%
146′ 6½″ to 157′ 7½″

B.S.1

Section taken in mine workings.

Bottom Seam			Description
M.%	1·0		Roof :- Coaly Shale
V.M.%	19·9		2¼″ Bluey 4″ Coal. ½″ Brown Sh. 2¾″ Coal 2″ Bluey. ¾″ Brn. Sh. 1″ Coal 1½″ Bluey. ¾″ Coal 1″ Bluey 1½″ Coal ¼″ Bluey. 1″ Coal ¼″ Brn. Sh. ½″ Bluey 6¾″ Coal. 1¼″ Bluey 3″ Brn. Sh. 1″ Carb. Sh. & 1½″ Coal. Bluey.
F.C.%	40·4		
A.%	38·7		
S.%	0·35		
Joules/Gm.	20340		
B.T.U./lb.	8750		
S.G.	1·647	Excluded	
M.%	1·1		1′3½″ Coal & Bluey c ½″ Carb. Sh. 9½″ from top.
V.M.%	22·2		½″ Brn. Sh.
F.C.%	47·7		12″ Coal.
A.%	29·0		
S.%	0·51		
Joules/Gm.	24420		
B.T.U./lb.	10510		Floor :- Carb. Shale
S.G.	1·526		

To accompany report by
A. K. Denmead Asst. Chief Govt. Geol.

V.B.B. 16.3.'56

DEPARTMENT OF MINES, QUEENSLAND

GEOLOGICAL MAP

MORETON & MORETON EXTENDED MINE AREA

IPSWICH COALFIELD

Parishes of Chuwar & Ipswich

County of Stanley

Warden's District of Ipswich

Showing

Geology, Topography & boreholes

To accompany report by A.K.Denmead M.Sc.
Surface mapping by J.O.Cuthbert, H.R.E.Staines & B.W.Hawkins B.Sc.
Topographic Survey by E.Cowley

Scale of Chains

5 4 3 2 1 0 5 10 15 20

Grid of 20chn. co-ordinates. Meridian of grid is True North at origin, an arbitrary point, being bolt in concrete block on road near angle in Eastern boundary of Sub.1, Por.213, Parish of Ipswich. Elevations on State Datum.

LEGEND

- Established geological boundary - position accurate
- Established geological boundary - position approx.
- Inferred, probable or indefinite boundary
- Established fault - position accurate
- Established fault - position approx.
- Established fault - concealed
- Inferred, probable or indefinite fault
- Inferred, probable or indefinite fault, concealed
- High angle fault
- Ipswich Coal Measures
- Alluvium
- Coal Seam at Surface
- Outcrop
- Strike & dip of strata
- Strike & dip of joints
- Colliery (Working) — HAIGHMOOR
- Colliery (Abandoned) — NOBLEVALE A
- Adit — ADIT
- Shaft
- Diamond Drillhole — ⊙N.S.61
- Percussion Drillhole — ○Bore 11(P)
- Surface Contours

ROTHWELL HAIGH EXTD · ROTHWELL HAIGH No.3 A · ROTHWELL HAIGH No.1 A · ROTHWELL HAIGH No.5 A · ROTHWELL HAIGH No.2 A · ROTHWELL HAIGH No.6 · ROTHWELL HAIGH No.4 A · GLENCOE A · NEW ECLIPSE A · MORETON A · MORETON EXTD · HORSE TUNNEL · OLD TUNNEL · SOUND TUNNEL · ECHO TUNNEL · GULLANDS TUNNEL A · TANTIVY A · DOLLY A VARDEN TUNNEL · ENGINE A TUNNEL · EDINA TUNNEL A · ABERMAIN A · RYLANCE ABERMAIN No.2 · OLD TUNNELS

N.S.68 RL Col 122·65 RL Surf 119·35 RL Btm -282·27
N.S.74 RL Col 155·95 RL Surf 154·70 RL Btm -22·05
N.S.71 RL Col 168·95 RL Surf 167·66 RL Btm -270·05
N.S.70 RL Col 158·20 RL Surf 154·38 RL Btm -514·47
N.S.69 RL Col 175·30 RL Surf 172·79 RL Btm -581·03
N.S.72 RL Col 104·87 RL Surf 100·37 RL Btm -845·96
N.S.73 RL Col 49·20 RL Surf 48·20 RL Btm -766·80
N.S.75 RL Col 84·39 RL Surf 83·09 RL Btm -597·86
N.S.76 RL Col 70·31 RL Surf 69·01 RL Btm -829·19
N.S.79 RL Col 85·15 RL Surf 84·00 RL Btm -1137·85
N.S.80 RL Col 61·42 RL Surf 60·67 RL Btm -1126·58
N.S.77 RL Col 71·75 RL Surf 67·57 RL Btm -1059·00
N.S.78 RL Col 71·82 RL Surf 69·75 RL Btm -582·85

Railway Workshops · Bremer River · Alluvium · IPSWICH · PARISH OF

38000N · 36000N · 34000N · 32000N · 30000N · 28000N · 26000N · 22000W · 20000W · 18000W · 16000W · 14000W · 12000W

LOCALITY MAP

SCALE OF MILES 2½ 2 1½ 1 ½ 0 2½

200W 00 200E 400E · 400N 200N 00 200S

HAIGHMOOR AREA · ABERMAIN AREA · R.HAIGH AREA · MORETON EXT. AREA · WESTFALEN AREA · BUNDAMBA AREA · SWANBANK LAGOON AREA · Riverview · Dinmore · Redbank · Ebbw Vale · Bundamba · Booval · IPSWICH · East Ipswich · BRISBANE RIVER

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

MORETON & MORETON EXTENDED MINE AREA

IPSWICH COALFIELD

Parishes of Chuwar & Ipswich

County of Stanley

Warden's District of Ipswich

Showing boreholes, mine workings and areas within which reserves have been estimated

To accompany report by A.K.Denmead M.Sc.

Survey by E.Cowley

Scale of Chains

0 5 10 15

Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in E. bndry. of Sub1, Por.213, Psh. Ipswich. Elevations on State Datum. Grid of 20 Chn. co-ordinates.

LEGEND

Colliery (Working) NEATH — Borehole ◎

Colliery (Abandoned) NEATH A — Seam section measured ⊕

Shaft — Fault (posn. accurate) ——

Adit — Fault (posn. approx.) — —

Cross section line X —— X1

Elevations taken from mine plans & adjusted to State Datum ◎ 247'

Boundary of measured reserves on Eclipse seam ——

" " " " " Fiery seam – – –

" " " " " Garden seam .....

Limit of mine workings :- Eclipse seam ------ Tivoli seam.....

Waterstown seam ——— Fiery seam ——— Tantivy seam ———

Garden seam ———

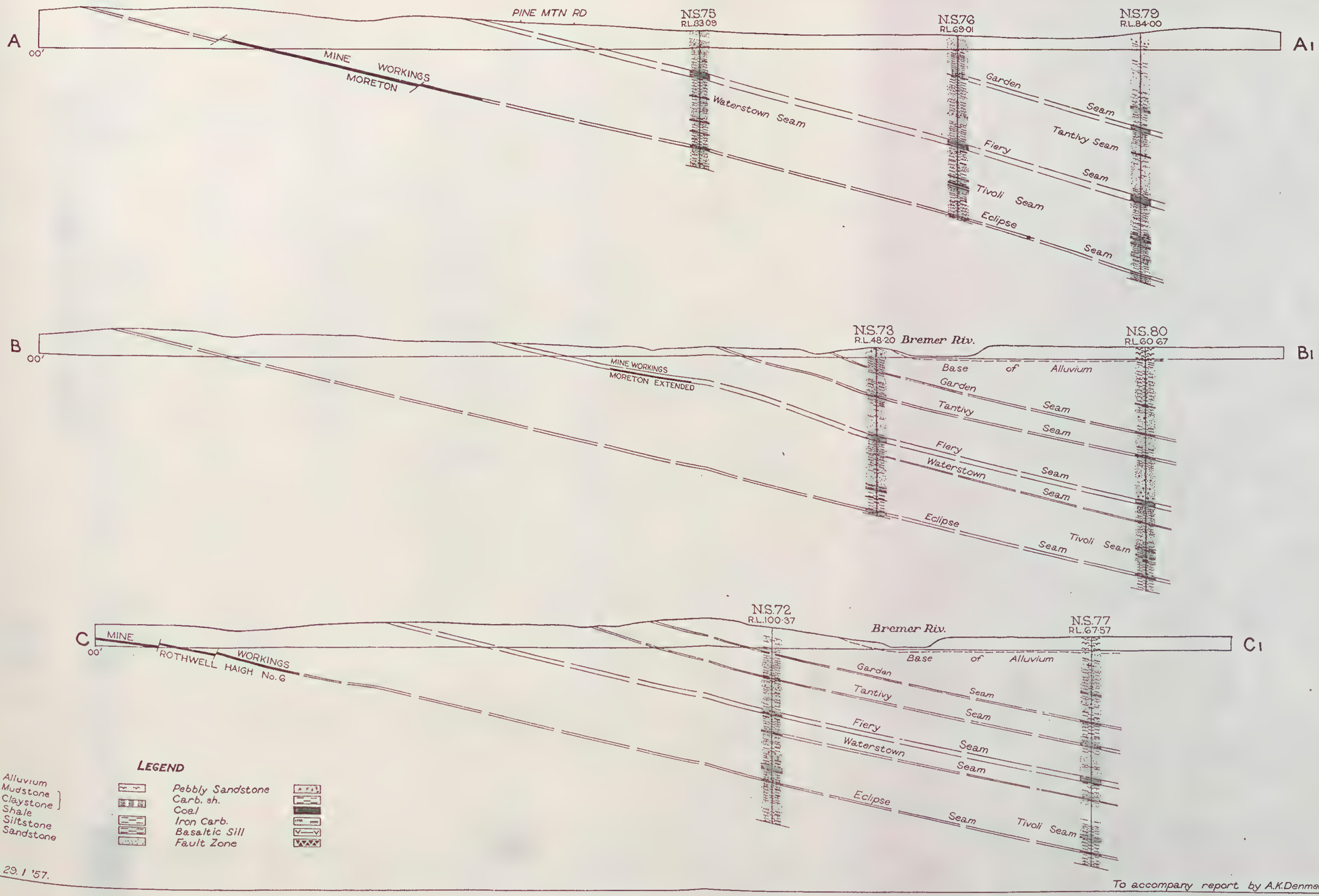
V.B.Belkoff del.

MORETON AND MORETON EXTENDED MINE AREA — CROSS SECTIONS

Scale of Chains
5 0 5 10 15

Geological Survey of Queensland Publication No. 286

FIG. 3



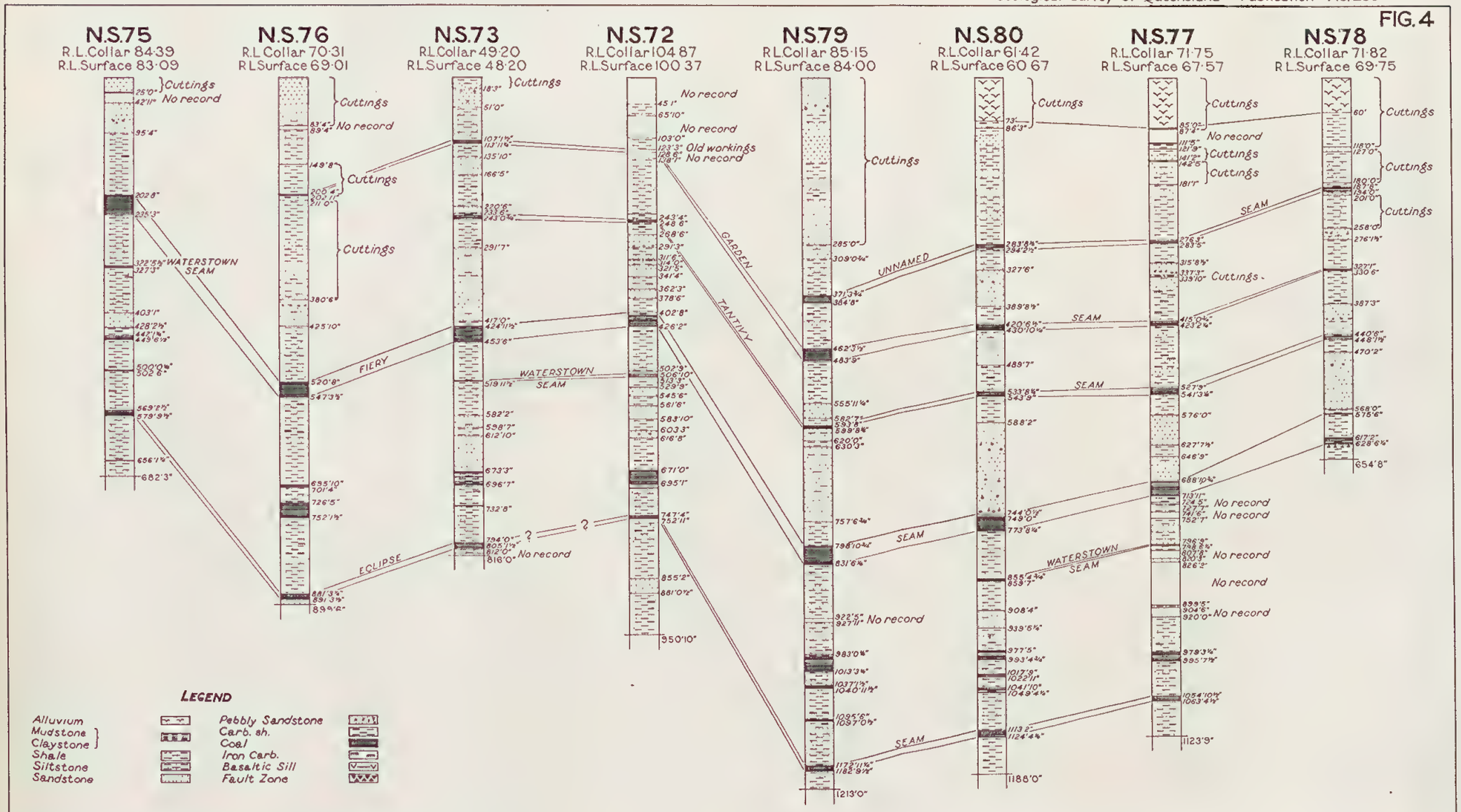
V.B.B. 29. 1 '57.

To accompany report by A.K. Denmead M.Sc.

MORETON AND MORETON EXTENDED MINE AREA. GENERALISED BORE LOGS.

Geological Survey of Queensland Publication No. 286

FIG. 4



NE 13 / 56

MORETON AND MORETON EXTENDED MINE AREA.

DIAGRAMS OF ECLIPSE SEAM, DETAILS OF CORE RECOVERY.

Geological Survey of Queensland Publication No. 286 **FIG. 5.**

Section N.S.73

Recovery per cent.	Section sampled	Description
		2½"(p.b.c) coal & bluey. ½"carb. sh. with coal lam.
		5¼"coal with carb. sh. lam
		½" brn. slts.
		2¼"coal ½"carb. sh. 2¼"coal.
		2¼" carb. sh. wth few coal lents ¾"brn.sh.
		3½"fn. sh.
		2¼"carb. sh. ¼"coal with carb. sh. lam.
		1½"carb. sh. with few coal lam. 1"coal with carb. sh.lam
		1¾"carb. sh. ¼"coal 1"carb. sh. 1½"coal ¾"carb. sh.
		¼"coal 2¼"carb. sh. with ¼"coal bands 1½"coal with few carb. sh. lam.
		9¾"coal & bluey bands
		½"carb. sh with coal lam. & lents. 1½"brn. sh.
		3¾"carb. sh with few thin coal bands
		5"coal & inf. coal with carb. sh. lam. ¼"carb.sh. ¼"brn sh. ½" fn. sh. ¼"brn.sh. ½"carb. sh. ⅛"fn. sh. ⅛"interbed.
		4"brn. & carb. sh. 1"lt. gy. sh. ¾"carb. sh. 2¼"coal
		1"carb. sh. & inf. coal 1"carb. sh. 1"dk. gy sh.
		4"bluey.
		799'8½" 1"(p.b.c) coal 2½"coal ½" bluey
		1½"coal ½"carb. sh. ½"coal ¾"carb.sh.
		2"coal ⅛"boulder 1¼"coal & inf coal.
		1'4¼"(p.b.c) coal with carb. sh lam
97·51		½"coal 1¼"bluey 1"coal.
		1"coal & carb. sh. lam. 1¼"carb. sh.
		11"(p.b.c) coal with few carb. sh. lam.
Excl.		803' 4" 1" brown sh. 1½"coal ¾"carb. sh. with coal lents.
		803' 8¾" 1"med. gy. sh. ½"carb. sh.
		4½"coal 1¼"med gy sh. grading to brn. slts
		5¾"(p.b.c) inf. coal & coal.
		½"carb sh. 2"(p.b.c.) coal.
		805' 1½" 1½"interbedded carb. sh. & coal 1½"(b.c) coal.

Section N.S.75

Recovery per cent.	Section sampled	Description
		579'2½" 4¼"coal & bluey lam. ¾"boulder.
		1¾"coal 2¼"bluey grading to inf. coal.
		1"coal ¼"carb. sh. 3"coal with carb sh parting in top
		¼"dk. fn. slts. 1½"coal & bluey lam. 4½"(p.b.c) coal.
		2"bluey with coal lents.
		5½"carb.sh. with coal lents.
		½"coal 1½"bluey with coal lents & nodular $FeCO_3$ in top.
		1½"(p.b.c) coal 1½"interbed- dk. gy. & carb. sh. with coal lents. & lenses 3½"(b.c.) coal & inf. coal 1¾"dk. gy. sh. 2¼"carb. sh.
		11"(p.b.c) coal & inf. coal.
		¾"carb. sh. 2"(b.c) inf. coal & bluey
		¾"dk. gy. sh. 2¼"carb. sh. ¾"dk gy. sh. ¼"carb.sh.
98·43		2'1"(p.b.c) coal & inf.coal with few thin bands of bluey.
		1'2" coal & inf. coal.
		1"carb. sh. with coal lents 2½"(b.c) coal with few carb. sh. lam. ½"carb. sh. 1¼"coal ¾"dk.gy. sh. 1½"carb. sh. with coal lents 1"coal ¼"carb. sh. 1¼"coal & inf. coal 1½"carb. sh. with coal lam. ¾"dk. gy. sh ¼"carb. sh.
		1'4"(b.c) coal & inf. coal
		579'9½" 2"coal with few sh. lam.

Section N.S.76

Recovery per cent.	Section sampled	Description
		881'3¼" 1½"coal 3"bluey.
		11¾"(p.b.c) coal & inf. coal.
		3½"carb. sh. with coal lents.
		7½"inf. coal grading to coal with carb. sh. partings.
		½"carb. sh ¾"buff sh. 2½"interbedded dk. gy. & carb. sh 1¾"carb. sh.
		3"inf. coal & bluey.
		5"coal & inf. coal.
		5"carb. sh.
		9"coal & inf. coal.
99 15		1½"bluey 2"coal & bluey lam. 1½"bluey.
		2"coal & bluey lam.
		2'9½" coal & inf. coal.
		1"dk. gy. sh. ½"carb. sh. 1¼"coal.
		2¼"dk. gy. sh.
		4½"(p.b.c) bluey & coal.
		2½"coal & inf. coal ½"bluey 1"dk. gy. sh.
		11½"coal & inf. coal.
		891'3½"

Section N.S.79

Recovery per cent.	Section sampled	Description
		1172'11¼" 3"coal.
		4¼"bluey with coal lenses & lents.
		2"coal.
		2'3¾"(p.b.c) coal & bluey lam. with 1"carb.sh.at 9"
		1¾"boulder with ¼"coal at ¾". 1"dk gy.sh.
		3½"carb. sh. with coal lents & lenses in top 1".
		6½"coal & inf. coal 80% & bluey 20%.
		¾"carb. sh.
83 93		1'0¾"coal & inf. coal.
		4"bluey with coal lents.
		11"coal with bluey lam.
		1'2" coal & inf. coal with few ½" bands of dk gy.sh
		1"dk. gy. sh. with coal lenses.
		2'0½"(b.c) coal & inf. coal.
		1182'9½"

Section N.S.80

Recovery per cent.	Section sampled	Description
		1114'5¼" 2¾"(b.c) coal 1¾"coal with thin calcite veins.
		1¾"bluey.
		½"coal 2½"(b.c) coal ¾"bluey.
		6¾" coal.
		1½"(p.b.c) bluey 60% coal 40%.
		3½"coal ½"coal ¼"inf. coal ½"brn. sh.
		3"coal.
		1¼"coal & inf. coal with ¼" bands lt. gy. sh. 1¾"(b.c) coal.
		2½"carb. sh. with few coal lents in top 1". 3"carb. sh. with ½"coal band.
		3"loose coal with some carb. sh. 2"coal.
100		2½"coal with ¼"band of carb. sh. 2¼"(b.c) coal.
		1"bluey 1"coal 1"carb. sh.
		¼"coal 2" bluey.
		2¾"coal 2½"(b.c) coal
		5"coal with ½"carb. sh. band.
		2½"(b.c) coal.
		3"coal with ½" gy. sh. band.
		2'2½"(b.c) coal.
		1122'2½" 1½"coal ¾"carb. sh.
100		1½"coal ¼"carb. sh. ¾"dk gy. sh. 2½"coal.
		1122'10¼" 2" dk. gy. sh.
100		1'6"(b.c) coal.
		1124'4¼"

Section E.S.1

Section taken in mine workings.

Section sampled	Description
	Roof - lt. gy. sh. & carb. sh. bands & bluey (clod).
	1'1" coal.
	1½"med. gy. sh.
	3"carb. sh. grading to bluey with coal lam.
	5"coal & inf. coal.
	10"interbedded coal & carb. sh. (becomes inferior laterally).
	2'1" coal with penny bands of sh. from 1'1" to 1'2" & lenticular carb. sh. bands from 1'2" to 1'6".
	.. or - lt. gy. sh

VBB. 4/9/56.

To accompany report by A K Denmead M.Sc.

MORETON AND MORETON EXTENDED MINE AREA. DIAGRAMS OF FIERY SEAM DETAILS OF CORE RECOVERY

Geological Survey of Queensland Publication No. 286 FIG. 6

Recovery per cent.	Section sampled	Section N.S.72	Description
			6¼"dk gy. sh. with coal lents. & lenses.
			5" coal & inf. coal.
			1" boulder 2¼" dk gy. sh. 1½" carb. sh.
			3(b.c) coal. with coal lents
			2¼" carb. ph. with coal lents. & ¼"
			2" coaly sh. 2" carb sh. dk gy.sh at ¾".
			2½" (b.c) carb.sh. & some coal.
			6" carb. sh. with coal lents.
			7½" dk gy. sh. with coal lents.
			2½" coal 2½" dk gy. sh.
			8" (b.c) coal.
			1" dk gy.sh. 2" Coal.
			4½" dk. gy. sh. & carb. sh.
			2" coal.
			1'6" (b.c) coal with thin bands of dk. gy. sh. & carb. sh.
			11½" interbedded fn & carb. sh
			1½" coal ½" carb. sh. 1½" coal 1" coaly sh
			1¼" carb. sh. ¾" fn. sh. 1" inf. coal.
			½" dk. gy. sh. 1" bluey 2" inf. coal.
			3" (b.c) coal ½" carb. sh. with coal lents.
			1¼" fn. sh. 3" bluey.
			2½" fn. sh. 1" carb. sh. 1½" fn. sh.
			½" coal 1" carb. sh. 2½" coal & carb. sh. bands
			2½" brn. grading to fn. sh. ½" inf. coal ½" carb. sh.
			3" fn. slts. ½" carb. sh. 1½" coal ½" carb. sh.
			½ coal 1½" fn sh with carb lam. ½" carb sh
			½" coal ½" carb sh 3" (b.c) coal
			1" carb. sh with coal lents 4½" coal & inf coal
			5½" (b.c) coal 50% & bluey.
			1¾" fn sh 2¾" bluey.
			1¼" fn sh 1" bluey 1" (b.c) coal
100	142/54/G.S.	415' 4"	2" carb sh 1" (b.c) fn sh 2" coal & carb sh lam
			1'4¾" coal.
		416'10¼"	1¼" boulder 2" carb. sh. with coal lents.
			4" (b.c) coal & inf. coal.
			1" carb. sh. 4¾" fn. sh.
			1¾" carb. sh. with coal lents & ½" fn sh at ¾".
			1" dk fn sh ¾" bluey 1" inf. coal 2" fn sh
		419'4¼"	2½" carb sh. 1" fn. sh.
			7" carb. sh with coal lam. & ½" fn sh at 5".
			4½" coal & inf. coal.
			2" (b.c) coal. ½" coal ½" carb. sh. ½" coal.
			3½" fn. sh.
			1¼" carb. sh. 1¾" coal 2" bluey.
			8½" coal & inf. coal.
			½" carb. sh. 2½" fn. sh. 2½" carb sh.
96 33	138/54/G.S.		1'1½" coal.
			1" boulder 4" carb. sh.
			5" coal with carb. sh. bands.
			7¾" carb. sh. with coal lam.
			4½" coal.
			5" carb. sh.
			1¼" bluey 1¾" coal with ½" fn sh. lens in middle 1¼" bluey 2½" coal
		426'2"	2" bluey with coal lents 1½" coal.
			8¼" carb. sh. with ½" boulder at 6¼".
			5½" fn. slts
			9¾" l. gy. slts. grading to sh.

Recovery per cent.	Section sampled	Section N.S.73	Description
			5" fn. sh. with carb. lam.
		428'7½"	1" coal 2¼" fn. sh.
100	133/54/G.S.		1'2¼" (p.b.c) coal & bluey.
		429'5⅛"	¾" fn. sh. 3" carb. sh.
100	141/54/G.S.		2½" bluey ½" fn. sh. 2" bluey ½" fn. sh.
		430'8½"	1¾" bluey with ½" irreg. fn. sh. lens.
			8½" (b.c) coal with ½" boulder at 7½".
			3½" (b.c) coal.
			½" carb. sh. ¾" coal ¼" carb. sh.
100	134/54/G.S.		5" fn. sh. with ½" carb. sh. at 4"
			½" carb. sh.
			2'8½" coal with ¾" fn. sh. at 11½" and a few thin carb. sh. bands.
		434'9"	¼" fn. sh. 1½" bluey grading to carb. sh
			3" fn. sh. 2¼" coal.
		445'9"	2" inf. coal 1½" fn. slts. ½" carb. sh.
			½" l. gy. slts. 4" bluey & coal.
			8½" coal with 1" bluey at top.
			1" bluey 3" fn. sh.
			6" coal.
			1½" bluey 1½" coal ½" carb. sh ¼" fn. sh.
			1" coal 2" carb. sh. with coal lents
			1½" coal 1" bluey 1¼" fn. sh
			1'3½" coal & inf. coal with carb. sh bands & ½" brn. sh. at 4".
97 85	135/54/G.S.		2¼" boulder.
			4¾" (p.b.c) coal ½" carb sh. ¼" brn sh.
			4¼" (p.b.c) coal with carb. sh parting at 1¼". ½" carb. sh
			4½" coal. [at 1½"
			5" carb. sh. & coal lam. with 1½" coal
			½" carb. sh. 6" (p.b.c) coal.
			1¼" carb. sh. 1½" fn. sh.
			2" bluey ¼" coal 1" dk. gy. sh.
			8" (p.b.c) coal & bluey.
			3½" bluey & coal 2" coal.
		453'6"	3" carb. sh
			2'0" l. gy. slts grading to sh.

Recovery per cent.	Section sampled	Section N.S.75	Description
		202'10"	¼" carb. sh. ¼" brn. sh. 1¼" carb. sh. with coal lents.
			1'7" (b.c) coal & inf. coal.
100	139/54/G.S.		1" coaly sh. 1½" l. fn. sh. 1" carb. sh with coal lents.
			7½" bluey with coal bands & lents.
			1" brn. sh. 1¼" coal.
		205'11¾"	2¼" carb. sh. with coal lents. & ¾" brn. sh.
			3" (b.c) coal & carb. sh. 4" dk. gy. sh.
			2¼" carb. sh. with coal lents.
			1" carb. sh. 1" inf. coal ½" carb sh 1" fn sh.
		222'1½"	1'3" coal & inf. coal & bluey with four ¼" bands of brn. sh
			1¼" carb. sh. 2" fn. sh.
			8½" (p.b.c) coal & inf. coal with 10% bluey
			3½" (b.c.) fn. sh.
			8½" (b.c) bluey with coal lents.
			1'2½" (b.c) coal & inf. coal.
			2¼" boulder 4" coal & inf. coal with sh. parting at 3". 1½" carb. sh. with fn. sh. parting 5" (b.c) coal & inf. coal ¼" carb. sh. 1¾" coal.
			5½" (b.c.) bluey.
			6½" (b.c) coal with ¼" carb. sh. at 5½"
			2" carb. sh. 1½" fn. sh. 1¼" dk. gy. sh
			2" bluey with coal lents.
			1'3" coal & inf. coal with 1" carb. sh at 1½"
		233'3½"	1½" boulder 1½" inf. coal 2" fn. slts.

Recovery per cent.	Section sampled	Section N.S.76	Description
		520'8"	1½" gy. f. ss. 4" med. wh. ss
			2" bluey 1" coal 1" bluey.
			5" coal.
			1" bluey 4" coal.
			3½" boulder.
			1'2" (p.b.c) coal.
			½" d. gy. sh. 2½" bluey grading to inf. coal.
			½" carb. sh. 1" fn. sh.
92.9	136/54/G.S.		2'10" (p.b.c) coal & inf. coal & ox & bluey with ¼" boulder at 7½".
			¼" fn. sh. ¼" carb sh 1½" dk fn. sh ¾" carb. sh
			1¾" inf. coal 1" coal 1" bluey.
			3½" coal. 1½" coal & inf coal with carb. sh lam. 3" (b.c) coal.
		327'8½"	7" carb. sh. with coal bands.
			3" coal.
			3" carb. sh. & coal lam.
			2" dk. gy. sh. 1½" dk fn. sh.
			4" carb. sh. with coal lam
			6½" (p.b.c) coal & inf. coal.
100	143/54/G.S.		3" coal & carb. sh. lam. 2" carb. sh
			6" coal.
			½" bluey 1" fn. sh. ½" coal ¼" fn. sh.
			¾" coal 1¼" carb. sh. with coal lents. 1½" coal.
			½" carb. sh. 2" fn. sh. 2½" irreg. interbed. inf. coal & fn. slts 3½" coal & inf. coal.
			½" fn. sh. ¾" bluey.
			5½" coal & inf. coal with ¾" carb sh at 3".
			2" fn. sh. 1" (b.c) coal 1½" carb. sh. with coal lam. ¾" fn. sh. 1" coal 1½" carb. sh. with coal lents. 2½" (b.c) coal 2" fn. slts. impreg. with a little Fe Co.
			6" inf. coal grading to coal.
			1½" fn. sh. 1½" carb. sh. & coal lam 2½" (p.b.c) coal grading to inf. coal 1" bluey ½" carb. sh
			1" fn. sh. 1" bluey 4" coal.
		535'1½"	
		540'1"	5½" coal & bluey.
			3" brn. & fn. sh.
			1'2" coal with numerous bluey lam. and few carb. & fn. sh. lam.
100	137/54/G.S.		2¼" fn. slts.
			5½" coal & bluey with ¼" fn sh at 2¼"
			11" (b.c) coal & bluey lam
		543'8¼"	2½" coal.

Recovery per cent.	Section sampled	Section N.S.80	Description
		752'7"	1" coal 1" bluey
			1½" inf. coal 1¾" bluey
			1'2½" (p.b.c) coal & inf. coal with bluey bands & brn. sh. lenses from 6½" to 7"
			5½" fn. sh with ¾" dk gy sh at 3"
			1" carb. sh.
			10¼" coal & bluey bands.
			1½" bluey with dk gy. sh. at 1".
			12" coal & bluey bands with carb sh partings
			¼" dk gy. sh. 1¾" bluey with coal lenses ¼" dk fn sh
			¾" bluey 2½" carb. sh with coal lents 1½" fn sh
100	234/54/G.S.		6½" bluey with coal lam. & ½" carb. sh at 1½".
			¾" carb. sh. 1¼" coal & inf coal 1" bluey.
			2" inf. coal ¾" carb. sh.
			1¼" coal & bluey lam. 1¼" carb. sh.
			9½" bluey with coal bands.
			¾" carb. sh. ¾" fn. sh. 1" bluey 1¾" (b.c) coal & inf. coal ½" carb. sh. 1½" fn. sh. ¼" coal.
			1¼" carb. sh. 1½" fn. sh.
			4½" bluey with coal lents
			1½" fn. sh. ½" carb. sh.
			4½" (b.c) coal ½" bluey, 1" coal grading to inf. coal ¼" carb. sh. 2¾" fn. sh. ¼" carb sh
			4" coal & inf. coal with bluey bands & brn sh parting in middle 1" bluey 3" (b.c) coal
			¼" carb sh. 1½" fn sh. ½" carb sh with coal lents
		762'10"	7¾" coal & inf. coal with bluey lam.
			½" carb. sh. 1" fn sh. ½" carb sh ½" inf. coal.
			¼" brn sh ½" carb sh 2¾" bluey with coal lam.
100	235/54/G.S.		1" fn. sh ¾" bluey ½" carb. sh ½" dk gy sh
		764'1½"	3" (b.c) coal, inf. coal & bluey 2¼" med gy sh
			¾" fn. sh. with carb lents. ½" carb. sh.
			5½" (b.c) bluey 70% coal 30% carb. sh 5%
			1'6½" (p.b.c) coal & inf. coal with few bluey bands.
			¼" dk gy sh. 1" carb. sh.
100	201/54/G.S.		5" coal & bluey bands
		766'9¼"	1½" carb. sh.
			4½" fn sh.
100	202/54/G.S.		¾" carb sh 2½" bluey with coal bands
			¾" dk fn sh. ¾" inf. coal 2¼" fn sh.
			2½" bluey ½" inf. coal & bluey lam ½" dk gy sh
		768'3½"	1¾" inf. coal 1" carb sh
			3½" (b.c) bluey 50% carb sh 45% coal 5%
			9½" (p.b.c) coal & inf. coal with ¼" carb. sh ½" from top.
100	203/54/G.S.		¾" carb sh ¾" med gy sh
			3½" fn sh 2" bluey with ½" coal in middle.
			5¼" (b.c) coal.
			5½" carb. sh
			1" bluey.
			6½" bluey & coal lam.
			1¼" boulder 14" l. to med gy. sh.
			9" (b.c) coal & inf. coal.
			1½" carb. sh ¼" coal 1" carb. sh.
			1½" inf. coal 1¼" bluey.
			3" coal grading to inf. coal
			5" carb. sh. with ½" fn. sh at 2".
		773'8¼"	3" inf. coal with bluey lam.

To accompany report by A.K. Denmead M.Sc.

V.B.B. 6/7/56

MORETON AND MORETON EXTENDED MINE AREA. DIAGRAMS OF GARDEN AND TANTIVY SEAMS, DETAILS OF CORE RECOVERY.

Geological Survey of Queensland. Publication No. 286 FIG. 7

Recovery per cent	Section sampled	Section N.S.77	Description
		GARDEN	
		413' 11¼"	
		416' 7¼"	2¾" coal ¾" coal & carb. sh. bands. 1" carb. sh ½" bluey. 6" (p.b.c.) coal ¼" dk. gy. sh. 3" coal. 7" interbedded coal & bluey. 3½" carb. sh. & coal lents. 2'0" coal grading to bluey in btm. 4".
100			
	Excl.	420' 8"	¼" fn. sh. 1" bluey 1" carb. sh 5" fn. sh. 2½" carb. sh
		421' 5¾"	1' 1¾" (b.c.) coal & inf. coal with few fn. sh. partings at 1½". ¾" carb. sh. ½" coal ½" carb. sh. 5" (b.c) coal & inf. coal.
		423' 1¾"	
		425' 2½"	

Recovery per cent.	Section sampled	Section N.S.79	Description
		GARDEN	
		461' 5"	
		463' 10½"	6¼" coal with carb. sh. partings at 2¾" & 3¼". ¾" fn. sh. 1¾" coaly carb. sh. ¾" coal. 2¼" bluey 2½" inf. coal. 5½" (b.c.) coal. ½" carb. sh. 3" inf. coal. 3¼" mainly coal with bluey bands. 1' 1½" (p.b.c.) coal. 2½" coal 2" boulder. 6¼" coal. ½" carb. sh. 2" dk. gy. sh. 6" (p.b.c.) coal. 1" boulder 1½" (p.b.c.) coal. 1½" inf. coal. 1'0" (p.b.c.) inf. coal & coal. 2¾" fn. sh. 3¼" coal. 1' 4¼" (p.b.c.) coal. 1¼" bluey. 3¾" coal with bluey lam. ½" carb. slts. & l. gy. slts.
100			
		472' 7"	2¼" coal with carb. sh. lam.

Recovery per cent.	Section sampled	Section N.S.80	Description
		GARDEN	
		420' 9"	
		421' 10¾"	7½" (p.b.c) coal. 3½" (b.c.) fn. sh. ½" coal 1½" carb. sh. with coal lents. 6½" (b.c.) coal. 1½" carb. sh. with ⅛" brn. sh. at 1". 8½" (b.c.) coal. ½" boulder. 8½" coal with bluey bands. ½" carb. sh. 1½" inf. coal. 1" carb. sh. 2" (b.c.) fn. sh. ¼" carb. sh. 2' 4¼" (p.b.c.) coal & inf. coal. 2" dk. gy. sh. grading to med. gy. sh. 1¼" carb. sh. 2' 0½" (p.b.c.) coal & inf. coal with few bluey bands.
100			
		430' 0½"	
		433' 0"	

Recovery per cent.	Section sampled	Section N.S.80	Description
		TANTIVY	
		535' 1¼"	
		538' 9¼"	2½" coal with carb. sh. lam. ¼" carb. sh. 1¼" l. gy. sh. 9½" (p.b.c.) coal & inf. coal. ½" brn. sh. ⅛" coal. ½" carb. sh. 6" (b.c.) coal & inf. coal. 1½" carb. sh. 1" (b.c.) coal ½" l. gy. sh. 3½" (b.c.) coal ¾" carb. sh. 5" (b.c.) coal & inf. coal. 2¾" med. gy. sh. 7⅛" (b.c.) coal & inf. coal with ½" carb. sh. in middle. 6" inf. coal & bluey lam. 5¾" (b.c.) coal. ⅛" carb. sh. 1" bluey. 4" inf. coal & bluey lam.
100			
		543' 9"	
		547' 4"	

V.B.B. 26/10/56.

To accompany report by A.K. Denmead M.Sc.

FIG. 8

DEPARTMENT OF MINES, QUEENSLAND
SKELETON PLAN

MORETON & MORETON EXTENDED MINE AREA
IPSWICH COALFIELD

STRUCTURE CONTOURS
ECLIPSE SEAM

To accompany report by A.K. Denmead M.Sc.

Drawn & prepared by V.B. Beikoff

Scale of Chains

5 0 5 10 15

20 Chn. grid on True North. Elevations on State Datum.
Structure contours on base of seam.

LEGEND

Colliery (working) NEATH — Borehole ◎
Colliery (abnd.) NEATH A — Structure contours —0—
Adit — Fault (posn. accurate) ——
Shaft — Fault (posn. approx.) - - -
Fault inferred, probable or indefinite —?—?—
Structure contours above ground level ·····0·····

ROTHWELL HAIGH No. 6

MORETON A

34000N

32000N

30000N

28000N

26000N

20000W

18000W

16000W

14000W

100 50 0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100

Tivoli

Ck.

N.S. 72 ◎

N.S. 73 ◎

N.S. 75 ◎

N.S. 76 ◎

N.S. 77 ◎

N.S. 79 ◎

N.S. 80 ◎

BREMER RIVER

BREMER RIVER

FIG. 9

DEPARTMENT OF MINES, QUEENSLAND
SKELETON PLAN

MORETON & MORETON EXTENDED MINE AREA

IPSWICH COALFIELD

STRUCTURE CONTOURS

FIERY SEAM

To accompany report by A.K.Denmead M.Sc.

Drawn & prepared by V.B.Beikoff

Scale of Chains

5 0 5 10 15

20 Chn. grid on True North. Elevations on State Datum.
Structure contours on base of seam.

LEGEND

Colliery (working) NEATH	Borehole ◎
Colliery (abnd.) NEATH A	Structure contours –0–
Adit	Fault (posn. accurate) ——
Shaft	Fault (posn. approx.) – – –
Fault inferred, probable or indefinite	–?–?–
Structure contours above ground level	·····0·····

34000 N
32000 N
30000 N
28000 N
26000 N
20000 W
18000 W
16000 W
14000 W

Tivoli
MORETON EXTENDED
Ck.
BREMER RIVER
BREMER RIVER

+50
0
-50
-100
-150
-200
-250
-300
-350
-400
-450
-500
-550
-600
-650
-700
-750

N.S.72 ◎
N.S.75 ◎
N.S.73 ◎
N.S.77 ◎
N.S.76 ◎
N.S.80 ◎
N.S.79 ◎

FIG. 10

DEPARTMENT OF MINES, QUEENSLAND
SKELETON PLAN

MORETON & MORETON EXTENDED MINE AREA
IPSWICH COALFIELD

STRUCTURE CONTOURS
GARDEN SEAM

To accompany report by A.K. Denmead M.Sc.

Drawn & prepared by V.B. Beikoff

Scale of Chains

5 0 5 10 15

20 Chn. grid on True North. Elevations on State Datum.
Structure contours on base of seam.

LEGEND

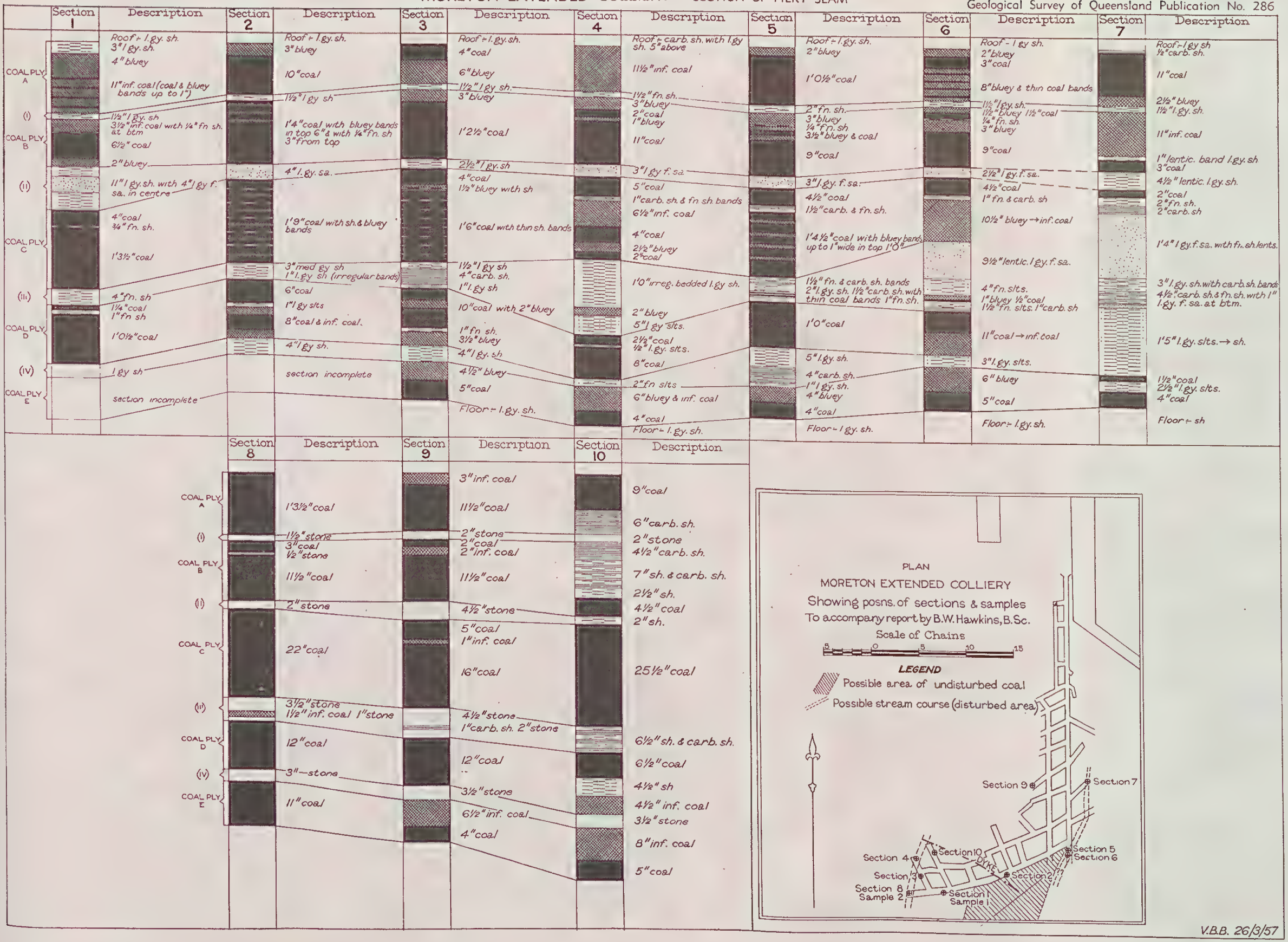
Colliery (working)	NEATH	Borehole	◎
Colliery (abnd.)	NEATH A	Structure contours	–0–
Adit		Fault (posn. accurate)	——
Shaft		Fault (posn. approx.)	– – –
Fault inferred, probable or indefinite			–?–?–
Structure contours above ground level			·····0·····

34000 N
32000 N
30000 N
28000 N
26000 N
20000 W
18000 W
16000 W
14000 W

Tivoli
Ck.
BREMER RIVER
BREMER RIVER
DOLLY VARDEN TUNNEL A
GULLANDS TUNNEL A
N.S.72 ◎
N.S.75 ◎
N.S.73 ◎
N.S.76 ◎
N.S.77 ◎
N.S.79 ◎
N.S. 80 ◎
+100
+50
0
–50
–100
–150
–200
–250
–300
–350
400

MORETON EXTENDED COLLIERY — SECTION OF FIERY SEAM

Geological Survey of Queensland Publication No. 286



V.B.B. 26/3/57

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 287

QUEENSLAND BUILDING AND MONUMENTAL STONES

By
K. W. WOLFF, B.Sc., Assistant Geologist

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QUEENSLAND BUILDING AND MONUMENTAL STONES

SUMMARY REPORT.

Compiled by K. W. Wolff, B.Sc., Assistant Geologist.

INTRODUCTION.

THIS report summarises all the information, available at this department, on the main Queensland deposits of rocks, suitable for building and monumental purposes. Building masons and quarry masters were consulted and they supplied much useful data.

Following on the wide use of stone, in the construction of many of the buildings erected in the late years of the last century and the early part of this century, Ball (1905) and Richards (1918) presented detailed reports on the Queensland building stones.

The more important factors to be considered in the development of stone deposits are accessibility, colour, texture, appearance, hardness, strength, workability and durability of the stone, and also the ease of quarrying.

Large quantities of high quality building and monumental stone are readily available in Queensland. As regards appearance, colour, working properties and durability, the majority of our stones must be ranked first class and equal or even superior in quality to much of the imported material.

The Queensland stones may be classified in three main groups which can be further subdivided—

I. Igneous.

(1) Plutonic.

(*a*) Granite and associated rocks including grano-diorite, quartz-diorite, and diorite.

(2) Volcanic.

(*a*) Rhyolite and trachyte.

(*b*) Basalt.

(*c*) Tuff or "porphyry."

II. Sedimentary.

(*a*) Sandstone.

III. Metamorphic.

(*a*) Marble.

(*b*) Serpentinite.

QUEENSLAND DEPOSITS.

I. Igneous.

(1) PLUTONIC.

(*a*) Granite, &c.

In this report the term granite is used in its wider usage to cover all rocks of granitic texture.

Granites are well distributed in Queensland particularly as regards proximity to the main coastal cities and towns. They range in colour from pink to various shades of grey, and in texture from fine even-grained to coarse prophyritic.

The following are the principal known sources.

(i.) *Enoggera Granite.*—Occurring a few miles to the west of Brisbane, the Enoggera granite mass is extremely variable in the minerals present, their relative proportions, grain size and fabric. The pink phase is predominant over the grey and the major part of the granite is uniform flesh coloured and composed of plagioclase, orthoclase, quartz, biotite, hornblende and chlorite. Pyrite was present in some of the early stone taken from this area and due to its unsightly weathering products gave the stone an unfavourable reputation. After this staining caused by the weathering of pyrite was noticed, only stone free from pyrite was worked, and gave excellent results. Ample supplies of pyrite-free material are available.

The Enoggera granite is tough, takes a very good polish, resists abrasion and weathers well. It has a high resistance to crushing, a specific gravity of 2·59 and a weight of 162 pounds per cubic foot.

Considerable use has been made of this granite in building and monumental work. Enoggera granite was used in the following Brisbane buildings:—Executive Building, Central Technical College, Government Printing Office, and in the bed blocks of Victoria Bridge and base of Queen Victoria's statue.

MAP I
QUEENSLAND
SHOWING
DISTRIBUTION OF BUILDING & MONUMENTAL STONES
To accompany Report by K.Wolff, B.Sc., Asst. Geologist
1956

SCALE OF MILES
80 40 0 80 160

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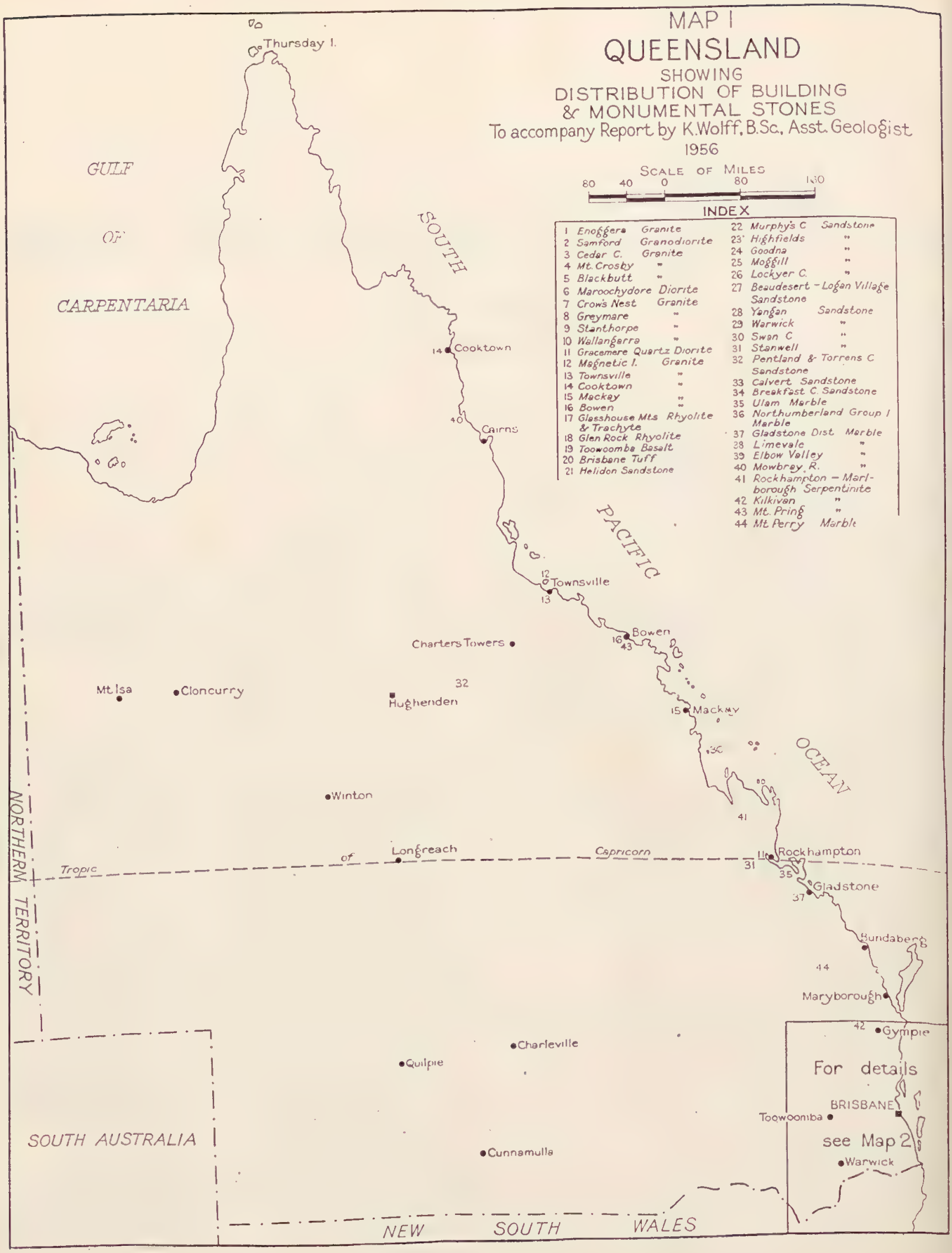


Quarries are located in the Ashgrove area. Kerr's quarry was worked by W. Kerr for building and monumental stones, but of late has been taken over by the Stirling Granite Coy. and used as a source of road metal.

(ii.) *Samford Granodiorite.*—The Samford Granodiorite is a light-grey, medium to coarse-grained rock of fresh appearance and high resistance to weathering agencies. It outcrops over a wide area in the Samford and Camp Mountain districts. The rock is comprised of plagioclase felspar, quartz, potash felspar, biotite, hornblende, pyroxene and magnetite. Crushing tests carried out on approximately 7-inch cubes have given results averaging about 19,500 pounds per square inch; specific gravity is 2·74, and weight 172 pounds per cubic foot.

Quarries are located in subdivision 3, portion 97, parish of Samford, county of Stanley, and worked for building and monumental stone by Messrs. P. J. Lowther and Son. Pty. Ltd., Lutwyche road, Bowen Hills, Brisbane. Samford Granodiorite is to be seen in the base of the City Hall, Brisbane; the major part of the base of the University of Queensland, St. Lucia, Brisbane; and the Cairncross Dry Dock, Brisbane.

For a time Mr. A. G. Stronach quarried the granodiorite at Camp Mountain. This stone is to be seen in the Australian Mutual Provident Society Building, Queen street, Brisbane. No quarrying is at present carried on at Camp Mountain.

(iii.) *Cedar Creek Granite.*—A pink granite of good quality outcrops in the Cedar Creek district, about 15 miles from Samford, and has been used with pleasing results in both building and monumental work. Increased demand could lead to a renewal of quarrying operations in this area.

Pink granite from Mr. A. G. Stronach's Cedar Creek quarry in the north-west part of portion 79v, Samsonvale, was used with excellent results in the Australian Mutual Provident Society Building, Queen street, Brisbane.

(iv.) *Mount Crosby (or Kholo) Granite.*—An unusually dark granitic rock occurs in the Mount Crosby area, about 12 miles W.S.W. of Brisbane. It is a dark greenish-grey, medium-grained rock of even texture. Plagioclase, augite, and biotite are the main constituents. All the minerals are very stable, and the stone does not seem to have any mineralogical or structural defects, and has an excellent appearance when polished. Its specific gravity is 2·84 and weight 177 pounds per cubic foot. Supplies for a number of buildings, including the Executive Building, Brisbane (where it has been used in alternate layers with the Enoggera granite); the Commonwealth Savings Bank, Albert street, Brisbane, and the Royal Insurance Building, Brisbane, have been drawn from this area. In those buildings no signs of deterioration of the stone have been noticed. Some acidic veins and basic segregations are to be seen but limited supplies of uniform grade rock of fairly large size are available. Quarries located in portion 43, Kholo, were worked for building and monumental stone. At present no quarrying is being done.

(v.) *Blackbutt Granite.*—The granitic outcrop in the Blackbutt district of the Brisbane River Valley covers a large area. Here the rock is a dark grey, medium-grained, even-textured, tonalite of bright appearance and with evenly distributed, well formed, dark minerals. The main constituents are plagioclase, quartz, biotite, hornblende and others. This stone takes a good polish and has a high resistance to weathering agencies. Its specific gravity has been determined as 2·87 and weight as 178 pounds per cubic foot.

Of late Blackbutt has become an important source for the supply of grey granite to the building and monumental trades. Quarries worked by P. J. Lowther and Son are located in portions 99v and 100v, parish of Taromeo, about 1½ miles to 2 miles distant from Blackbutt. This stone has been used in the State Government Building, Anzac Square, Brisbane, the Commonwealth Bank, Rockhampton, and the Commonwealth Bank, Ingham. Blackbutt granite is shown to advantage in the Nash Memorial, Gympie.

(vi.) *Maroochydore Diorite.*—A deposit of hornblende diorite occurs in subdivision 308, portion 7, parish of Mooloolah, county of Cavendish, about 2½ miles from Maroochydore. The rock is made up essentially of plagioclase felspar and hornblende phenocrysts embedded in a groundmass of plagioclase felspar, with magnetite and ilmenite. It is bluish-grey, fine- to medium-grained, with, particularly in the marginal areas, large hornblende phenocrysts which enhance its appearance. The stone works well and takes an excellent polish. Resistance to weathering is remarkably high. The specific gravity is 2·70 and its weight per cubic foot about 169 pounds. Crushing tests gave an average result of 1,483 tons per square foot. The quantity of overburden is slight and the jointing such that commercial blocks are readily available. This deposit, which is easily accessible, occupies an area of approximately 12 acres and reserves have been estimated at one million cubic yards.

(vii.) *Crow's Nest Granite.*—Outcropping to the north and east of Crow's Nest and within easy reach of the town is a pink, medium-grained granite. Apart from a few small aplite veins which can be easily avoided in quarrying, the granite is very uniform. The jointing is rectangular and large blocks of high quality stone could be obtained. Quarries could be readily selected.

A grey granite occurring about 6½ miles north of Crow's Nest is quarried intermittently for monumental work, by R. Zeigler & Sons of Toowoomba on portion 17v, parish of Aduramba, county of Cavendish.

(viii.) *Greymare Granite.*—At Greymare, 20 miles west of Warwick, a grey granite outcrops over large areas. The stone has a clean black and white appearance, coarse grain, works well, and takes an

Executive Building, George St., Brisbane.—Base course alternate layers Enoggera Granite (light) and Mount Crosby Granite (dark). Main structure is Helidon Sandstone (Wright's Quarries) with columns of Yangan Sandstone.

Taxation Building, George Street, Brisbane.—Base course of Greymare Granite, balance is Sandstone from Wright's Quarries, Helidon.

State Government Insurance Building, Adelaide Street, Brisbane.—Base course is Blackbutt Granite, balance is Sandstone from Lowther's Quarry, Helidon.

excellent polish. This granite is composed of quartz, plagioclase, orthoclase, biotite, chlorite and magnetite. Weathering properties are good. It has a specific gravity of 2·66 and a weight of 166 pounds per cubic foot. The appearance of the stone varies according to whether it has been worked with the rift or with the grain. When worked with the rift, that is parallel to the flat flakes, the large black mica flakes give the rock a spotted appearance.

Surface boulders of Greymare granite have been worked for monumental and building purposes. It has been used in the Technical College Building, Warwick; the base of the Taxation Building, George and Elizabeth streets, Brisbane, and parts of the base of the University of Queensland, St. Lucia.

P. J. Lowther and Son worked surface boulders at Greymare and supplied the material for the University. No quarrying of Greymare granite is at present being undertaken.

(ix.) *Stanthorpe Granite.*—The Stanthorpe granite is a strongly pink, coarse-grained rock occurring over a wide area in the Stanthorpe district. It is mainly composed of quartz, orthoclase, plagioclase and biotite. This stone has had minor use in monumental work, but no rock has so far been quarried for building purposes.

(x.) *Wallangarra Granite.*—In the immediate vicinity of the township of Wallangarra is a large mass of beautiful dark-grey porphyritic granite, with large orthoclase crystals set in a groundmass of quartz, orthoclase, plagioclase, hornblende, augite and sphene. The presence of large porphyritic crystals set in a dark groundmass makes this rock admirably suited for decorative purposes. Weathering properties of the stone appear to be very good. The specific gravity of the Wallangarra granite is 2·69.

So far as is known, no attempts have been made to use this exceptionally beautiful stone.

(xi.) *Gracemere Quartz Diorite.*—At Gracemere about 7 miles from Rockhampton, a first class grey granitic rock occurs. In comparison with other Queensland grey granites, there is much more dark mineral in this stone, giving it a rich dark appearance. The rock is deep bluish-grey, medium-grained, and becomes darker still on polishing. Quartz, plagioclase, biotite, hornblende and magnetite are the main minerals present. It works well, takes a fine polish and is very weather resistant. Of specific gravity 2·933 and weight 183 pounds per cubic foot, this stone is non-absorbent and has a crushing resistance in excess of 950 tons to the square foot. Light-coloured acid veins and basic segregations appear to be absent in the rock and joints are few and indistinct.

Considerable demand now exists in the monumental and building trade for this stone. Quarrying is being carried on by Messrs. F. M. Allan and Co., Rockhampton, about 2¼ miles south of Gracemere railway station. Gracemere granite was used in the base of the Dental Hospital, Turbot street, Brisbane, and in part of the Cairncross Dry Dock, Brisbane.

(xii.) *Magnetic Island Granite.*—There is a pale-pinkish, medium-grained, granite outcropping in appreciable amounts on Magnetic Island. The rock is composed of quartz, felspar, biotite, hornblende, and magnetite. From this area stone, which takes a good clean polish and weathers well, has been obtained. Magnetic Island granite is used in building and monumental work, and is to be seen in the Customs House at Townsville.

(xiii.) *Townsville Granite.*—In and about Townsville a reddish, medium- to coarse-grained granite occurs. It consists of quartz, felspar, ferromagnesian minerals, and chlorite. While this stone has quite a rich red appearance, polishes well and withstands weathering processes it is somewhat lacking in relief. It has been used to a minor extent in monumental and building works. Melrose and Fenwick Pty. Ltd., Townsville, until recently were quarrying this stone.

(xiv.) *Cooktown Granite.*—A light-grey, porphyritic granite outcrops over an area about 3 miles in diameter in the Cooktown area. This stone of good working properties is used in the monumental trade.

(xv.) *Mackay and Bowen Granites.*—Granites of good appearance, varying grain size and texture, occur over wide areas in close proximity to these towns. In the event of an increased demand for granitic stone, these deposits would provide a ready source of supply.

(2) VOLCANIC.

(*a*) Rhyolite and Trachyte.

Although large and conveniently situated deposits of light-coloured rhyolites and trachytes occur in Queensland, no use has yet been made of these stones in buildings and monuments. These good quality volcanics are in many ways superior to sandstones although more costly to dress. They would probably come into use if an increased market for building and structural stone were created.

(i.) *Glass House Mountains Rhyolites and Trachytes.*—Light-grey fine-grained volcanic rocks occur over wide areas in the Glass House Mountains

Part of a stockpile of granite blocks in Allen & Sons' Quarry, Gracemere, Rockhampton.

St. John's Anglican Cathedral, Brisbane.—Main Structure is of Brisbane Tuff.

Interior of St. John's Cathedral, Brisbane.—Interior Walls, Ceilings, and Piers are of Sandstone from Wright's Quarries, Helidon.

Cook Monument, Cooktown.—Murphy's Creek Sandstone on base of Cooktown Granite.

district. The presence of dark-blue and dark-green ferromagnesian minerals gives these rocks a pretty appearance. The main mineral constituents are sanidine, soda-rich augite, and minor quartz. Working qualities are good and the stone has an excellent appearance both rock-faced and smooth-dressed. The stone has a high resistance to weathering. The specific gravity ranges from 2·47 to 2·71, and weight from 154 to 169 pounds per cubic foot. Glass House Mountain volcanics have a high resistance to crushing, are practically non-porous and lie in close proximity to rail transport.

To date no material has been taken for building or monumental work from this area.

(ii.) *Glen Rock (Esk District) Rhyolite.*—A large deposit of light yellow-brown rhyolite occurs south of Esk and within easy reach of rail transport. The rock contains few "phenocrysts" and is composed of glassy material with quartz, anorthoclase and sanidine. Zeolites occur, in some cases, filling cracks in the rock. Rhyolite from this outcrop works freely, dresses well and has a fine appearance. It is non-porous and is fairly resistant to crushing. Specific gravity is 2·43 and weight 152 pounds per cubic foot.

No stone has been taken for building and monumental purposes but if an increased market was created, this deposit could become an important source of high quality, durable stone.

(*b*) Basalt.

Basalts are fairly common in Queensland and vary in texture from fine to coarse and vesicular. They are extensively used for kerbing and road-making material. Although in some cases regarded as too dark and gloomy in appearance, some basalts have been used for building material.

(i.) *Toowoomba Basalt.*—In and about Toowoomba an important olivine basalt outcrops. It is a medium- to coarse-grained rock, hard, heavy and weather resistant and composed of olivine "phenocrysts" in a groundmass of mainly plagioclase felspars and augite, with minor amounts of olivine, magnetite and glass. This basalt has been widely used for guttering and kerbing and has had minor structural use. It is to be seen in a number of Toowoomba buildings, including St. Luke's Anglican Cathedral and Downlands College.

Quarries are now operated by the Toowoomba City Council.

(c) Tuff.

The Brisbane Tuff or "porphyry," as it is known in the building trade, has proved to be a most valuable asset to Brisbane for road-making, kerbing, retaining-wall, and building purposes. Of variable colour through white, pink, green, yellow, brown, and purple, the tuff is composed of occasional small mineral crystals of quartz, orthoclase and plagioclase set in a fine devitrified felspathic groundmass. Typical material is of specific gravity 2·16 and weight 135 pounds per cubic foot. Rough-dressed stones, having been subjected to less disturbance, weather much better than smooth-dressed.

The tuff occurs in a belt stretching through Brisbane in a north-south direction and having a width of about half a mile.

Quarries have been worked at Kangaroo Point, Spring Hill, and Windsor. At Stafford the tuff is actively quarried by Messrs. W. H. Bowser and Lever, Windsor, Brisbane. Tuff excavated in connection with building operations in the inner city area has been utilised. Owing to its restricted occurrence, supplies of tuff are limited. Windsor quarry is to be reopened to supply material for the additions to St. John's Anglican Cathedral, Ann street, Brisbane.

Tuff has been extensively used in retaining-walls, monuments, ornamental works, including walls, paths and porches, and buildings. In addition Brisbane Tuff was the main constituent in the Benedict Stone, which was manufactured over a short period in Brisbane and employed in some buildings. Chips of tuff were added to a coloured cementing-medium in the preparation of Benedict Stone.

Brisbane buildings in which tuff was used include St. Paul's Presbyterian Church; St. Stephen's Roman Catholic Cathedral; St. John's Anglican Cathedral; Criminal Investigation Branch, Police Department Building, George and Elizabeth streets; Rosemount Hospital, and in the base of the Treasury Building; General Post Office; Government Printing Office, and in Emmanuel College, St. Lucia.

Benedict Stone is to be seen in the Colonial Mutual Life Assurance Building, Queen street, Brisbane, and in the Shell Company of Australia, Shell House, Ann street, Brisbane.

II. Sedimentary.

(*a*) Sandstone.

In Queensland all sandstones used or likely to be used are of Lower Mesozoic age. Queensland has abundant supplies of good quality sandstone and although the Helidon stone is the only sandstone now actively quarried, an increased demand could lead to the reopening of many other deposits.

Sandstones show great variation and adjacent beds in the one quarry may exhibit considerable differences.

(i.) *Helidon Sandstone.*—The Helidon sandstone is variable in colour through white, brown, lavender, and pink. The preference amongst local architects for variegated and banded Helidon sandstone has been responsible for the recent development of many deposits which otherwise would have been discarded.

The Helidon stone is highly favoured for exterior and interior building and monumental work.

At Wright's Quarries, which are now being worked about 5 miles from Helidon on the northern side of the railway line, brown, pink, white, and

The University of Queensland, St. Lucia, Brisbane, Main Block, North Front.—Helidon Sandstone.

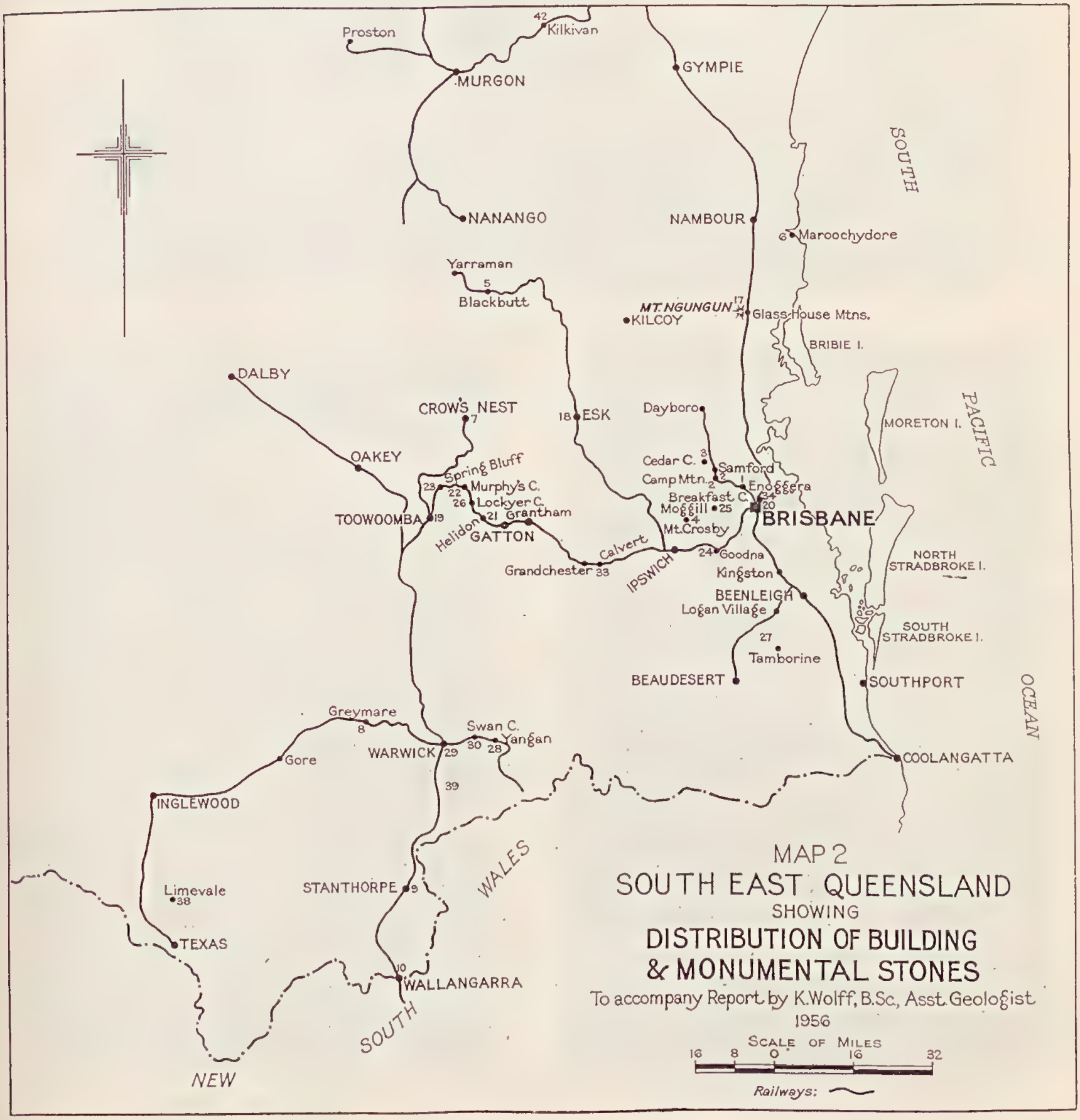
Entrance to Law School, University of Queensland, St. Lucia.—Helidon Sandstone.

The Cloisters, University of Queensland, St. Lucia, Brisbane.—Helidon Sandstone.

multi-coloured stones have been obtained. The sandstone is composed of quartz grain material, with a high felspathic cement content which accounts for its easy working properties. With specific gravity ranging from 2·26 to 2·42, an average weight of 146 pounds per cubic foot, the stone has an average resistance to crushing of 4,700 pounds per square inch. Tests for absorption in percentage of dry weight have given results ranging from 2·8 to 4·8. Unless exposed to constant moisture Helidon sandstone weathers well.

The Sandstone is horizontally bedded, with little overburden and the quarries take the form of shallow excavations.

Helidon stone from Wright's Quarries has had extensive use in building and monumental work. Stone from this quarry was used in the following Brisbane buildings:—Old Government House (University of Queensland), George street; Executive Building; St. John's Anglican Cathedral; Government Printing Office; Central Technical College; Elizabeth street front of the General Post Office;



Court House and Post Office, Toowoomba.—Built of Murphy's Creek Sandstone.

St. Joseph's Cathedral, Rockhampton.—Stanwell Sandstone.

Petrie's Quarry, Helidon.

University of Queensland, St. Lucia; Commercial Bank, Creek and Queen streets; Taxation Building, Elizabeth and George streets, and also in the Post Office, Ipswich, and the Court House, Bundaberg.

The sandstone used in the City Hall, Brisbane, was obtained from a small quarrying area adjacent to Wright's Quarries and then operated by Mr. D. D. Carrick.

Lowther's Quarries are actively worked and high quality sandstone of good weathering properties and similar in type to that at Wright's quarries is obtained. Considerable colour variations also exist in these quarries. Stone from Lowther's workings has been extensively used in monuments and buildings included amongst which are the University of Queensland, St. Lucia, Brisbane; parts of the Treasury Building, Brisbane; Emmanuel College, St. Lucia, Brisbane; State Government Building, Anzac Square, Brisbane; Commonwealth Savings Bank, Albert street, Brisbane, and the Commonwealth Savings Bank, Ingham.

Helidon sandstone veneer is at present being used in the modernisation of the "Old" Courier Building, Queen street, Brisbane, and in the Australia and New Zealand Bank, Queen street, Brisbane.

Pearson's Quarries located to the north-west of Helidon were worked for a time. The sandstone is typical Helidon stone. Pink, white, and brown stone has been taken out and used in buildings and monuments. Specific gravity ranges from 2·20 to 2·38, and crushing resistance from 2,035 to 8,884 pounds per square inch. Details concerning tests are to be found in the accompanying table.

These quarries supplied stone for the South Brisbane Town Hall, pink sandstone parts of Central Railway Station, Brisbane, and parts of the Treasury Building, Brisbane.

Jude's Quarry—White Helidon sandstone from this quarry was used in the construction of the second wing of the Treasury Building, facing George street and the eastern part of Elizabeth street.

Miller's Quarry—Located several miles west of Helidon, this quarry has supplied mainly brown sandstone. Its specific gravity has been calculated as 2·31, its weight as 144 pounds per cubic foot and absorption as 4·36 per cent. Details of tests appear in the table. Stone from Miller's Quarry was used in the Presbyterian Church, Toowoomba, and in the Roman Catholic Church, Ipswich. This site was purchased and worked in turn by the State Government and P. J. Lowther and Son.

Phippard's Quarry—The white Helidon sandstone here is of specific gravity 2·33, weight 145 pounds per cubic foot and variable resistance to crushing, ranging when tested from 3,606 to 6,371 pounds per square inch. The major part of the sandstone used in the Central Railway Station, Brisbane, came from Phippard's Quarry.

(ii.) *Murphy's Creek Sandstone.*—In the Murphy's Creek area, approximately 20 miles from Toowoomba, an important white to brownish, medium- to coarse-grained sandstone of good weathering qualities occurs. The cementing-medium is argillaceous with varying amounts of secondary silica. Samples tested have given the following results:—Specific gravity ranging from 2·18 to 2·60, and weight 136 to 163 pounds per cubic foot; resistance to crushing is fair. The use of this commendable sandstone has been marked with considerable success.

Quarries were located at Cameron, 4 miles from Murphy's Creek railway station, Montgomery; McLachlan and Sheddon.

Murphy's Creek sandstone has had important use in monuments and buildings. It is to be seen in the following buildings:—Public Library, William street, Brisbane; columns of Treasury Building, George street, Brisbane; portion of the General Post Office, Brisbane; portion of the Customs House, Brisbane; Queensland National Bank (National Bank of Australia), Queen street, Brisbane; portico of Old Government House, George street, Brisbane; gate piers of Botanic Gardens, Brisbane; colonnade of Parliament House facing George street, Brisbane; Post Office, Toowoomba; Court House, Toowoomba; Railway Station, Toowoomba; Customs House, Maryborough.

(iii.) *Highfields Sandstone.*—A large deposit of white, medium-grained sandstone occurs in the Spring Bluff area about 9 miles from Toowoomba. Generally soft with a high proportion of cementing-material, this stone weathers badly and becomes discoloured. However some variation in the sandstone does exist and better material can be located.

Quarries were worked for building and monumental requirements about 1½ miles west of Spring Bluff.

The first wing constructed of the Treasury Building, Brisbane, facing Queen, William, and the western part of Elizabeth streets was of Highfield sandstone on a tuff base.

(iv.) *Goodna Sandstone.*—The Goodna district has produced some high quality stone for Brisbane buildings. Here a light-pink to light-brown, medium-grained sandstone with argillaceous cementing-material occurs. Much of the stone has excellent weathering qualities and maintains a clean appearance.

Jeay's Quarry was the most important source of supply. Material from this quarry was used in the major part of Parliament House, Brisbane; Old Government House (University of Queensland), Brisbane, and the wall of the Botanic Gardens in Alice street, Brisbane.

The Woogaroo Quarry supplied stone for the tower and tracery at St. Paul's Presbyterian Church, Leichhardt street, Brisbane; alterations to the Supreme Court, Brisbane, and for the wall at the South Brisbane Cemetery.

General Post Office, Queen Street, Brisbane.—Murphy's Creek Sandstone.

St. Mark's Church, Warwick.—Built of Sandstone from Bishop Tuffnell's Quarry, Warwick.

Geary's Quarry was worked for the stone used in the old St. Stephen's Roman Catholic Church, Elizabeth street, Brisbane.

(v.) *Moggill Sandstone.*—A whitish to grey and brown, fine-grained sandstone, in beds of varying thickness, occurs in the Moggill area. On testing for potential use by the Railway Department, some Moggill sandstone had a specific gravity of 2·39 and a weight of 149 pounds per cubic foot and absorption 2.98 per cent. by weight.

Quarries were worked on portions 110 and 111, parish of Moggill. From these sites, high quality, light-coloured sandstone of fairly good weathering properties and in reasonably large blocks, could be obtained. A quarry site is also to be found on portion 135, parish of Moggill.

Moggill sandstone was used in the west portion of the Alice street front of Parliament House, but the exact location of the quarry from which this stone was taken is unknown.

(vi.) *Lockyer Creek Sandstone.*—Quarries were located between Murphy's Creek and Helidon, about 75 miles west of Brisbane. Tests carried out in 1875, gave its specific gravity as 2·45, weight as 153 pounds per cubic foot and absorption as 3·7 per cent. Lockyer Creek sandstone was used in parts of the Dry Dock, South Brisbane.

(vii.) *Beaudesert–Logan Village Sandstone.*—A brown, coarse-grained, Bundamba-type sandstone outcrops in the Beaudesert–Logan Village area. Much of the stone is of poor quality, though some variation in the sandstone exists. Quarries were worked in the Logan Village and Tamborine districts. The stone was used in monumental work and for the Mundoolun Anglican Church at Mundoolun, a few miles from Tamborine.

(viii.) *Yangan Sandstone.*—From the Yangan district about 13 miles south-east of Warwick comes a brown, fine-grained sandstone of even texture with argillaceous cementing-material. The stone works well and takes a sharp arris. Tests carried out in 1901 on the stone gave the following results:—specific gravity 2·61 weight 163 pounds per cubic foot, resistance to crushing 2,800 pounds per square inch, and absorption 8.7 per cent. The bedding is more or less horizontal and the jointing widely spaced.

Yangan sandstone was quarried near the railway station. The stone was used for monumental and building works. It is to be seen in the Executive Building, Brisbane (columns and recessed walls of the William street, Queen's Park, and George street fronts, and in the upper stories of the Stephen's Lane front); the Royal Insurance Co. Building, Queen street, Brisbane; Byrnes' Statue; Post Office, Warwick; Technical College, Warwick; the Police Buildings, Warwick; and in parts of the Warwick Railway Station.

(ix.) *Warwick Sandstone.*—Large deposits of light-brown, medium- to coarse-grained sandstone are readily available in close proximity to the town. The cementing-material is felspathic and the sandstone is fairly porous and shows current bedding. In this area overburden is generally small.

The following quarries were worked for building and monumental stone:—

Gunn's Paddock Quarry—Stone from this quarry, about 2 miles north of Warwick, was used in the Presbyterian Church, Warwick.

Mitchell's Quarry (Gollan's Quarry)—Mitchell's quarry supplied the sandstone for the Warwick Convent.

Mt. Tabor Quarry—Located on a ridge running north-west from Mt. Tabor, the quarry here was worked for the stone used in the Police Buildings, Warwick; Railway Building (old portion), Warwick; Court House, Warwick; National Bank of Australia, Warwick, and in the rear of the Warwick Town Hall.

Sidling Quarries (including Bishop Tuffnell's quarry)—From these quarries, Warwick sandstone obtained was used in St. Mark's Anglican Church, Warwick; St. Mary's Roman Catholic Church, Warwick; Methodist Church, Warwick; and the Masonic Hall, Warwick.

(x.) *Swan Creek (Mt. Sturt) Sandstone.*—A brown, fine-grained, argillaceous sandstone has been quarried in the Mt. Sturt district, about 9 miles from Warwick. It was used in the front of the Warwick Town Hall and in the Old Railway Building, Warwick.

(xi.) *Stanwell Sandstone.*—Good quality sandstone occurs in the Stanwell area, about 20 miles from Rockhampton. The light-brown, medium-grained, sandstone works fairly easily and weathers well. It has been extensively used in monuments and buildings. Quarries are located about 2 miles from Stanwell railway station. Stanwell stone is to be seen in the following Rockhampton buildings:—Post Office; Roman Catholic Cathedral; Customs House; Anglican Cathedral; Technical College; Commercial Bank, and others. The stone was also used in the Customs House, Townsville.

(xii.) *Pentland and Torrens Creek Sandstone.*—In the Pentland and Torrens Creek areas near Charters Towers, a brown sandstone has been quarried for monumental use in Charters Towers and Townsville.

(xiii.) *Calvert Sandstone.*—A brown, fine-grained, even-textured sandstone with argillaceous cementing occurs in the Calvert area, a few miles from Grandchester, which is 44 miles from Brisbane. In 1896 the stone was tested by the Railway Department and found to have a specific gravity of 2·39 and weight of 149 pounds per cubic foot. Resistance to crushing results of specimens tested ranged from 3,733 to 4,485 pounds per square inch. Weathering properties in many examples of this stone are not good. Calvert sandstone from Brodie's Quarry and from Beatty and Walsh's Quarry has been used in monumental and building work. It was utilised in parts of Castlemaine Brewery, Brisbane.

Main Dining Room, Tattersall's Club, Brisbane.—Pilasters and surrounds of figured Ulam Marble.

Lift Entrance, Ground Floor, State Government Insurance Office, Brisbane.—Figured Marble from Ulam, near Rockhampton.

(xiv.) *Breakfast Creek Sandstone.*—Breakfast Creek sandstone varies in colour from greyish-white to light-brown. It is a coarse-grained, very friable rock of poor weathering qualities. Cementing material makes up a large part of this stone. Within the beds some variation in the quality of stone has been noticed. Quarries were worked at Albion, Brisbane, above Breakfast Creek. This stone was used in the facings of St. Stephen's Cathedral, Brisbane; the base of Roma Street Railway Station, Brisbane; old building of General Post Office, Brisbane, and in the Caretaker's Lodge and fence of the Supreme Court, Brisbane.

III. Metamorphic.

(*a*) *Marble.*

Queensland is well provided with high class marbles. Our marble deposits exhibit wide ranges of colour and considerable variation in textures and in many cases possess all of the qualities of first class commercial marbles. Reserves of good grade material are extensive.

The marbles are crystalline, granular rocks composed mainly of calcite grains. Many marbles are more or less coloured by the presence of impurities such as carbonaceous matter and iron oxides.

(i.) *Ulam Marble.*—In the South Ulam area about 25 miles from Rockhampton, a large deposit of commercial marble occurs. This high quality marble is generally milky white, relieved in part by dark coloured markings and veinings, coarse-grained and fairly even-textured and shows translucence on the edges. Ulam marble is easily worked and takes a high polish, but owing to the coarse-granular nature, care is necessary with regard to arris. Weathering properties of the stone are good. Iron-bearing minerals are absent and no brown or yellow films develop on exposure to weather. Its specific gravity is 2·68 and weight 168 pounds per cubic foot. Absorption is low, being calculated as 0·14 per cent. by weight. Crushing resistance tests have given results of 5,570, 5,222 and 6,225 pounds per square inch. Jointing is inconspicuous but a few strong joints and some indistinct small ones are known to be present. Outcrops are noticed over a wide area and as the marble extends at depth, reserves would be great.

Quarries are at present operated about 14½ miles by road from Bajool railway station, by P. J. Lowther and Son.

Ulam marble has been extensively used in monumental, interior building, and terrazzo work. It is to be seen in the following buildings:—State and Commonwealth Government offices, Anzac Square, Brisbane; Penney's Building, Queen street, Brisbane; the Norwich Union Building, Queen street, Brisbane; Finney's Building, Queen street, Brisbane; State Government Insurance Offices, Adelaide street, Brisbane; Commonwealth Bank, Adelaide and Albert streets, Brisbane; Lennon's Hotel, George street, Brisbane; Tattersalls Club Building, Queen street, Brisbane, and others.

(ii.) *Northumberland Islands Marble.*—This group of islands is situated about 12 miles north-east of the northern end of Broad Sound Peninsula and midway between Rockhampton and Mackay. On some of the islands in the Northumberland Group limestones and marbles occur. Deposits are known on Mortar, Hunter, and Marble Islands.

The marble is present as interlaminations in the metamorphic rocks of Mortar Island. Colour variations are evident, pink, white, and blue predominating. Only small tonnages have so far been quarried. This marble takes a high polish.

Hunter Island contains three important deposits. These are—

Favosites Point—Here the marble occurrence is about 400 ft. in diameter. On the eastern side, white and blue marbles are overlain by slates, while on the western side pink marble is predominant. The reserves above high-water mark have been estimated at 250,000 tons.

Limekiln Beach—A comparatively thin bed of good quality ornamental marble, overlying slates occupies an area 400 ft. by 300 ft. The marble is variegated pink with some green veining and mottle grey.

Silica Hill—A large deposit of pink and green mottled marble is known.

Marble Island—On this island pink, white and bluish-grey marble occurs.

(iii.) *Gladstone District.*—In the Gladstone District deposits of marble are common. They vary in colour from white to dark blue and red and in grain from coarse to fine. Much of the stone is veined, mottled and brecciated, takes a beautiful polish and would be suitable for ornamental purposes. The most conveniently located deposits are in the Calliope area, about 10 miles from Gladstone.

So far only small amounts of marble have been taken from this area.

(iv.) *Limevale Marble.*—At Limevale, about 10 miles from Texas, a good quality marble is worked. Within this deposit centred about Limevale the variety of colour is great, bluish-white, greyish-white, light-grey, dark-grey, grey with white and rose-coloured veins and patches, mottled red, red, blue-black with yellow streaks, and black being present. The marble is even-textured, tough and firm, works well, takes a fine arris and is easily polished. In most cases the finished stone has an excellent appearance.

Large quantities exist and blocks of variable size may be obtained. Although used to some extent in monuments and buildings, the stone is largely worked for chip material for terrazzo. The deposit is quarried by the Marberete Coy., Lutwyche road, Bowen Hills, Brisbane.

Dove grey marble from Limevale was used in the Crematorium, Mt. Thompson, Brisbane, and in the Commonwealth Government Offices, Anzac Square, Brisbane, where it was used with the Ulam marble.

(v.) *Elbow Valley Marble.*—The deposit at Elbow Valley, about 20 miles from Warwick consists of generally pure white to cream-coloured fine-grained marble. Some of the material has been used for monumental and other purposes, but a large part of the output is taken for terrazzo work. Quarrying is done by the Marberete Coy.

Elbow Valley marble was used in the garage of Cribb and Foote Ltd., Ipswich.

(vi.) *Mowbray River Marble.*—In the Mowbray River area, a deposit of cream to white marble carrying in places thin, straight or undulating black bands, occurs as a lens about 5 chains long and up to 35 ft. wide interbedded with phyllites. The deposit occupies a position on the southern slope of a ridge overlooking the Mowbray River, about 2 miles from its mouth and approximately 10 miles south-east of Mossman. Much of the stone has a good appearance, is tough and solid and polishes well. Some of the stone should be ideal for ornamental purposes.

The deposit is quarried, but so far the whole of the output has been crushed and sold locally as a fertiliser.

(vii.) *Mount Perry District.*—In the Goodnight Scrub Reserve, 16 miles east of Mount Perry and within 6 miles of rail at Morganville, there are several occurrences of marmorized limestone of some prospective value as marble. They are vertically disposed beds up to 100 ft. or more wide. The main deposits are (a) about the junction of Limestone and Tenningering Creeks; (b) on Back Creek, ¼ mile to the south; and (c) near Kalliwa Creek.

The dominant colour is a light blue to grey; it is doubtful if high-class *white* monumental marble could be obtained. The possible commercial value of the deposits for marble production has not been investigated.

(*b*) Serpentinite.

Serpentinites may be fine- to coarsely-granular and are generally dark green in colour. They are composed essentially of serpentine minerals with chlorite, talc, magnesite, olivine, pyroxene, and hornblende. Specks and crystals of magnetite and chromite are common. Many serpentinites are saturated with secondary silica, which makes them much harder. Provided the rock selected is hard, firm and unaffected by weathering processes, the serpentinites would be ideal for ornamental work. Outcrops of good quality serpentine, which should take a fair polish, are known in the Rockhampton-Marlborough area, the Kilkivan district and at Mount Pring in the Bowen area.

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TABLE 1.

TABLE SHOWING CHEMICAL ANALYSES OF QUEENSLAND BUILDING STONES.

Rock.	Locality.	Silica.	Alumina.	Soda.	Potash.	Magnesia.	Lime.	Ferric Oxide.	Ferrous Oxide.	Water, &c.	Moisture.	Loss on Ignition.	Insolubles.	Other Constituents.	Total.
Granite ..	Enoggera	71·50	14·13	2·97	2·86	1·17	2·70	0·60	3·23	0·42	..	..	..	0·76	100·34
Granite ..	Samford	61·54	19·03	2·84	2·76	2·97	4·90	..	5·04	0·45	..	..	..	0·80	100·33
Granite ..	Greymare	69·70	17·70	3·12	1·36	3·12	2·29	1·94	1·40	0·72	..	..	..	0·19	99·61
Granite ..	Stanthorpe	76·19	11·53	3·80	4·14	0·60	1·14	0·84	1·25	0·28	..	..	..	0·50	100·27
Rhyolite ..	Mount Ngun Ngun Glass House Mountains	72·38	12·21	3·52	5·20	0·17	0·18	3·36	0·69	1·55	..	..	..	1·00	100·26
Rhyolite ..	Mount Conowrin Glass House Mountains	74·20	11·75	4·25	5·00	0·30	0·19	1·92	1·30	0·30	..	..	..	0·94	100·12
Rhyolite ..	Glen Rock, Esk ..	72·73	13·57	4·98	3·74	0·42	1·00	0·69	1·43	1·45	..	..	..	0·11	100·12
Basalt ..	Municipal Quarry, Toowoomba	50·27	12·50	3·29	1·42	10·25	7·52	2·44	8·18	1·60	..	..	..	3·04	100·51
Sandstone ..	Wright's Quarry, Helidon	90·80	0·7	..	..	trace	nil	3·7	..	4·90	..	..	..	..	100·10
Sandstone ..	Pearson's Quarry, Helidon	94·30	0·8 (includes ferric oxide)	..	..	..	0·3	..	..	4·60	..	..	..	..	100·0
Sandstone ..	Miller's Quarry, Helidon	90·90	0·5	..	..	trace	nil	0·3	..	5·4	..	..	..	..	100·1
Sandstone ..	Murphy's Creek ..	89·20	5·9 (includes ferric oxide)	..	..	trace	0·9	(included in alumina)	..	4·0	..	..	..	..	100·0
Sandstone ..	Highfields	80·50	14·0 (includes ferric oxide)	..	..	0·25	1·79	(included in alumina)	..	3·56	..	..	..	..	100·0
Sandstone ..	Yangan	93·50	3·1 (includes ferric oxide)	..	..	trace	0·40	(included in alumina)	..	3·0	..	..	..	..	100·0
Marble.. ..	Ulam	..	0·2	..	..	0·4	55·30	..	trace	..	0·1	43·8	0·2	..	100·0
Marble.. ..	Mowbray River ..	1·2	0·7	..	..	0·4	54·9	..	0·4	..	0·1	42·6	..	..	100·30
Marble.. ..	Elbow Valley	..	0·6 (includes Iron oxides)	..	..	0·3	54·7	..	..	..	..	43·0	1·2	..	99·8

TABLE II.

TABLE SHOWING RESULTS OF TESTS ON QUEENSLAND SANDSTONES (AFTER RICHARDS).

Stone.	Quarry.	Colour.	Specific Gravity.	Weight in Lb./ Cu. Ft.	Absorption Percentage of Dry Weight.	Resistance to Crushing.					Reference Authority.	Remarks as to Object of Tests and Character.
						Size of Specimen in Ins.	Cracking Pressure in Lb.	Crushing Pressure in Lb.	Crushing Resistance in Tons/ Sq. Ft.	Crushing Resistance in Lb. per Sq. In.		
Helidon Sandstone ..	Wright ..	Brown ..	2·42	151	4·33	6 x 3 x 3	..	43,700	305·42	4,751	Railway Department	Crushed dry on bed 26th April, 1901
Helidon Sandstone ..	Wright ..	Brown ..	2·42	151	4·39	3 x 3 x 3	..	38,970	299·10	4,537	Railway Department	Crushed dry on bed 26th April, 1901
Helidon Sandstone ..	Wright ..	Brown ..	2·42	151	4·70	3 x 3 x 3	39,000	46,750	330·40	5,140	Railway Department	Crushed dry on edge 26th April, 1901
Helidon Sandstone ..	Wright ..	Brown ..	2·28	143	4·00	3 x 3 x 3	..	48,160	344·00	5,350	Railway Department	4th April, 1899
Helidon Sandstone ..	Wright ..	Brown ..	2·42	151	4·80	4 x 4 x 4	..	36,000	144·60	2,250	Public Works Department	Executive Building tests, 1901
Helidon Sandstone ..	Wright ..	Brown ..	2·42	151	4·80	4 x 4 x 4	36,000	39,590	159·10	2,475	Public Works Department	Executive Building tests, 1901
Helidon Sandstone ..	Wright ..	Brown ..	2·42	151	4·80	4 x 4 x 4	42,500	49,690	201·20	3,130	Public Works Department	Executive Building tests, 1901
Helidon Sandstone ..	Wright ..	Brown ..	2·34	146	4·41	..	..	..	324·00	5,040	Public Works Department	Government Printing Office tests, 1911
Helidon Sandstone ..	Wright ..	Brown ..	2·34	146	4·41	..	..	..	344·25	5,355	Public Works Department	Government Printing Office tests, 1911
Helidon Sandstone ..	Wright ..	Brown ..	2·26	141	..	4 x 4 x 4	..	81,900	326·00	5,076	Public Works Department	Central Technical College, 1911 crushed dry on bed
Helidon Sandstone ..	Wright ..	Brown ..	2·26	141	2·8	4 x 4 x 4	..	58,940	233·00	3,634	Public Works Department	Central Technical College, 1911 crushed wet bed
Helidon Sandstone ..	Wright ..	Brown ..	2·30	143	..	3 x 3 x 3	..	54,720	385·71	6,000	Railway Department	Crushed dry on bed Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·30	143	..	3 x 3 x 3	..	61,550	439·66	6,700	Railway Department	Crushed dry on edge Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·30	143	..	6 x 3 x 3	..	43,680	310·13	4,824	Railway Department	Crushed dry on bed Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·30	143	3·55	6 x 3 x 3	..	33,720	238·55	3,710	Railway Department	Crushed wet on bed Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·37	148	..	3 x 3 x 3	..	71,780	509·48	7,925	Railway Department	Crushed dry on bed Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·37	148	..	3 x 3 x 3	..	75,610	538·81	8,381	Railway Department	Crushed dry on edge Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·37	148	..	6 x 3 x 3	..	60,640	432·70	6,731	Railway Department	Crushed dry on bed Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	2·37	148	2·86	6 x 3 x 3	..	36,760	260·05	4,045	Railway Department	Crushed wet on bed Central Railway Station, 1900
Helidon Sandstone ..	Wright ..	Brown ..	..	153	..	4 x 4 x 4	49,950	56,480	..	3,528	Public Works Department	Government Savings Bank tests, 1915
Helidon Sandstone ..	Wright ..	Brown ..	..	153	..	4 x 4 x 4	69,000	69,000	..	4,312	Public Works Department	Government Savings Bank tests, 1915
Helidon Sandstone ..	Wright ..	Brown ..	..	153	..	4 x 4 x 4	67,200	77,800	..	4,762	Public Works Department	Government Savings Bank tests, 1915
Helidon Sandstone ..	Miller ..	Brown ..	2·31	144	4·36	..	..	..	328·50	5,110	Public Works Department	Government Printing Office tests, 1911
Helidon Sandstone ..	Miller ..	Brown ..	..	148	..	4 x 4 x 4	42,560	51,744	..	3,234	Public Works Department	Government Savings Bank tests, 1915
Helidon Sandstone ..	Miller ..	Brown ..	..	148	..	4 x 4 x 4	41,440	41,440	..	2,590	Public Works Department	Government Savings Bank tests, 1915
Helidon Sandstone ..	Miller ..	Brown ..	..	148	..	4 x 4 x 4	47,488	47,488	..	2,968	Public Works Department	Government Savings Bank tests, 1915
Helidon Sandstone ..	Pearson ..	White ..	2·30	144	6·2	4 x 4 x 4	..	36,710	152·00	2,295	Public Works Department	Executive Building tests, 1901
Helidon Sandstone ..	Pearson ..	White ..	2·30	144	6.2	4 x 4 x 4	29,250	34,100	136·90	2,130	Public Works Department	Executive Building tests, 1901
Helidon Sandstone ..	Pearson ..	White ..	2·30	144	6·2	4 x 4 x 4	27,900	32,570	130·80	2,035	Public Works Department	Executive Building tests, 1901
Helidon Sandstone ..	Pearson ..	White ..	2·32	139	3·5	3 x 3 x 3	..	40,320	288	4,480	Railway Department	1899
Helidon Sandstone ..	Pearson ..	Brown ..	2·27	142	3·5	3 x 3 x 3	..	35,840	256	3,950	Railway Department	1899
Helidon Sandstone ..	Pearson ..	Pink ..	2·33	146	2·7	3 x 3 x 3	..	40,320	288	4,480	Railway Department	1899
Helidon Sandstone ..	Pearson ..	Purple ..	2·38	149	2·7	3 x 3 x 3	..	60,240	416	6,700	Railway Department	1899
Helidon Sandstone ..	Pearson ..	Brown ..	2·20	138	2·3	3 x 3 x 3	..	30,120	208	3,350	Railway Department	1899

TABLE SHOWING RESULTS OF TESTS ON QUEENSLAND SANDSTONES (AFTER RICHARDS)—*continued.*

Stone.	Quarry.	Colour.	Specific Gravity.	Weight in Lb./ Cu. Ft.	Absorption Percentage of Dry Weight.	Resistance to Crushing.					Reference Authority.	Remarks as to Object of Tests and Character.
						Size of Specimen in Ins.	Cracking Pressure in Lb.	Crushing Pressure in Lb.	Crushing Resistance in Tons/ Sq. Ft.	Crushing Resistance in Lb. per Sq. In.		
Helidon Sandstone ..	Pearson ..	White ..	2·21	138	..	3 x 3 x 3	..	51,340	365·5	5,685	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	White ..	2·21	138	..	3 x 3 x 3	..	65,380	468·5	7,287	Railway Department	Crushed dry on edge
Helidon Sandstone ..	Pearson ..	White ..	2·21	138	..	6 x 3 x 3	..	53,570	388·7	6,047	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	White ..	2·21	138	3·66	6 x 3 x 3	..	37,470	268·5	4,176	Railway Department	Crushed wet on bed
Helidon Sandstone ..	Pearson ..	Pink ..	2·26	141	..	3 x 3 x 3	..	53,580	386·4	6,011	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	Pink ..	2·26	141	..	3 x 3 x 3	..	65,280	467·0	7,334	Railway Department	Crushed dry on edge
Helidon Sandstone ..	Pearson ..	Pink ..	2·26	141	..	6 x 3 x 3	..	56,100	406·4	6,322	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	Pink ..	2·26	141	3·98	6 x 3 x 3	..	46,980	341·5	5,312	Railway Department	Crushed wet on bed
Helidon Sandstone ..	Pearson ..	Pink ..	2·37	148	..	3 x 3 x 3	..	80,970	571·1	8,884	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	Pink ..	2·37	148	..	3 x 3 x 3	..	79,180	560·2	8,714	Railway Department	Crushed dry on edge
Helidon Sandstone ..	Pearson ..	Pink ..	2·37	148	..	6 x 3 x 3	..	79,050	558·1	8,682	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	Pink ..	2·37	148	3·35	6 x 3 x 3	..	63,480	450·4	7,007	Railway Department	Crushed wet on bed
Helidon Sandstone ..	Pearson ..	White ..	2·24	139	..	3 x 3 x 3	..	39,180	278·5	4,333	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	White ..	2·24	139	..	3 x 3 x 3	..	55,650	397	6,175	Railway Department	Crushed dry on edge
Helidon Sandstone ..	Pearson ..	White ..	2·24	139	..	6 x 3 x 3	..	46,200	329	5,122	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	White ..	2·24	139	3·44	6 x 3 x 3	..	29,870	214	3,329	Railway Department	Crushed wet on bed
Helidon Sandstone ..	Pearson ..	Brown ..	2·26	141	..	3 x 3 x 3	..	43,030	304·9	4,743	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	Brown ..	2·26	141	..	3 x 3 x 3	..	52,570	373·7	5,814	Railway Department	Crushed dry on edge
Helidon Sandstone ..	Pearson ..	Brown ..	2·26	141	..	6 x 3 x 3	..	46,760	332·2	5,168	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Pearson ..	Brown ..	2·26	141	4·20	6 x 3 x 3	..	27,210	197·7	2,997	Railway Department	Crushed wet on bed .
Helidon Sandstone ..	Phippard ..	White ..	2·33	145	..	3 x 3 x 3	..	57,680	409·5	6,371	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Phippard ..	White ..	2·33	145	..	3 x 3 x 3	..	49,370	352·5	5,484	Railway Department	Crushed dry on edge
Helidon Sandstone ..	Phippard ..	White ..	2·33	145	..	6 x 3 x 3	..	50,760	360·7	5,612	Railway Department	Crushed dry on bed
Helidon Sandstone ..	Phippard ..	White ..	2·33	145	2·73	6 x 3 x 3	..	32,780	231·8	3,606	Railway Department	Crushed wet on bed
Yangan Sandstone ..	Midson ..	Brown ..	2·18	136	..	4 x 4 x 4	..	40,560	163·0	2,535	Public Works Department	Executive Building tests, 1901
Yangan Sandstone ..	Midson ..	Brown ..	2·18	136	8·7	4 x 4 x 4	..	43,120	173·2	2,695	Public Works Department	Executive Building tests, 1901
Yangan Sandstone ..	Midson ..	Brown ..	2·18	136	..	4 x 4 x 4	..	50,610	203·3	3,163	Public Works Department	Executive Building tests, 1901
Murphy's Creek Sandstone	..	Brown ..	2·41	150	..	4 x 4 x 4	..	52,470	210·9	3,280	Public Works Department	Executive Building tests, 1901
Murphy's Creek Sandstone	..	Brown ..	2·41	150	..	4 x 4 x 4	..	57,670	231·8	3,605	Public Works Department	Executive Building tests, 1901
Murphy's Creek Sandstone	..	Brown ..	2·41	150	5·0	4 x 4 x 4	..	59,400	238·7	3,712	Public Works Department	Executive Building tests, 1901
Calvert Sandstone ..	Downs ..	Brown ..	..	..	..	3 x 3 x 3	..	45,760	327·3	5,085	R. Ferguson ..	Tests conducted at Sydney Technical Colledge
Calvert Sandstone ..	Downs ..	Brown ..	..	..	..	3 x 3 x 3	..	45,510	325·1	5,057	R. Ferguson ..	Tests conducted at Sydney Technical College
Calvert Sandstone ..	Downs ..	Brown ..	..	..	..	3 x 3 x 3	..	32,890	234·8	3,654	R. Ferguson ..	Tests conducted at Sydney Technical College
Calvert Sandstone ..	Beatty and Walsh	Brown ..	2·39	149	4·47	..	..	..	240·6	3,733	Railway Department	Bremer Bridge test, 1896
Calvert Sandstone ..	Beatty and Walsh	Brown ..	..	..	..	..	..	..	288·3	3,385	Railway Department	Bremer Bridge test, 1896
Murphy's Creek Sandstone	..	White ..	2·18	136	5·1	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Murphy's Creek Sandstone	..	White ..	2·30	144	3·7	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Moggill Sandstone ..	Lyons ..	..	2·40	150	3·04	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Moggill Sandstone ..	Lyons ..	..	2·39	149·4	3·0	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Moggill Sandstone ..	Lyons ..	..	2·30	143·75	3·8	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Moggill Sandstone ..	Lyons ..	..	2·48	153·75	2·07	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Highfields Sandstone	..	White ..	..	..	4·8	..	..	..	..	..	W. Hamlet	Treasury Building Tests, 1888
Highfields Sandstone	..	White ..	..	..	7·0	..	..	..	..	..	W. H. Dixon ..	1886
Lockyer Creek Sandstone	..	..	2·45	153	3·7	..	..	..	..	..	Railway Department	Brisbane Dry Dock tests, 1875
Brisbane Tuff ..	Spring Hill	..	2·16	135	7·2	..	..	..	..	..	..	Brisbane Dry Dock tests, 1875

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QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

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COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 8. P.D.T.S. Nos. 9 AND 10 MINE AREAS, BLACKHEATH—BONNIE DUNDEE

By B. W. HAWKINS, B.Sc., Geologist

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SUMMARY.

Diamond drilling, based on the recommendations of Messrs. Powell-Duffryn Technical Services Ltd. to test these areas for the Four Feet and Bergin Seams, involved 17 boreholes (including two redrills and one short deflection) with aggregate depth of 13,541 ft.

This report, accompanied by 12 figures and 4 tables, sets out the results of the drilling which tested the full succession of the Blackstone "Stage" in the area.

The general geology of the area is described with particular reference to modifications of the typical succession in the coalfield. Variations in seam sections and intervening strata are discussed in some detail and the extent of deterioration of individual seams is indicated. The structural features of the area as affecting mining operations are also described.

Efficient drilling technique resulted in a very high percentage core recovery (average 98 per cent. in workable coal seams), so that strong reliance may be placed on sampling results and calculated reserves.

Analyses show the coals to belong to the high volatile bituminous group with average fixed carbon content, calculated on a dry-mineral-matter-free basis, of 62·8 per cent.

Washability tests, though incomplete, are sufficient to indicate that, for the seams tested, a final product carrying 20 per cent. ash could be obtained by discard of 25 per cent. For the Four Feet Seam, in which the bulk of reserves have been proved, washability tests were carried out only on those samples carrying more than 25 per cent. ash. Calculated on results from these samples, coal with 18·7 per cent. ash content could be produced by discarding 21·7 per cent. at sp. gr. 1·8, but in view of the many samples with lower ash content, it is to be expected that in practice the percentage discard would be lower. Coals from the Wright seam and Four Feet Top Coal would require washing to produce a marketable product.

Drilling has proved reserves in the Wright, Four Feet Top Coal and Four Feet Seams.

Measured reserves in the Wright Seam within an area of 34·4 acres have been calculated as 310,000 tons, which on washing would produce 220,000 tons of marketable coal.

In the Four Feet Top Coal, some 697,000 tons is available for mining to give on washing 410,000 tons of marketable coal.

Over an area of 418·9 acres, the Four Feet Seam averages 5 ft. 6½ in. in thickness with ash content of 25·9 per cent. Measured reserves have been calculated as 4,230,000 tons. Additional reserves might be expected to the east and north-east of the area tested and further drilling is proposed in these directions.

Boring has indicated that the Bergin Seam is workable in the south-eastern part of the area and it is anticipated that reserves will be proved by additional drilling.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.
PART 8—P.D.T.S. Nos. 9 AND 10 MINE AREAS, BLACKHEATH—BONNIE DUNDEE.

Introduction.

A departmental drilling programme was initiated in 1950 to implement recommendations made by Powell Duffryn Technical Services Ltd. This report sets out the results of diamond drilling in a further portion of the field tested.

P.D.T.S. Nos. 9 and 10 Mine Areas embrace the following working collieries, viz., Blackheath Nos. 1, 5, 6, and 7, Sunrise (Bonnie Dundee No. 2) and Edward S. Cornwall (Bonnie Dundee No. 6). The area lies some 2 miles south-east of Blackstone Village and covers an area of 580 acres to the south of Redbank Plains road. Immediately north of this road two of the sites proposed for P.D.T.S. No. 11 Mine Area, boreholes N.S. 89 and 92, were drilled during the present campaign. This increased the effective area drilled to 615 acres.

Procedure.

Diamond drilling plants were engaged in the area from 17th February, 1954 to 7th March, 1955. Two plants were engaged continuously while a third was employed for approximately half the time.

A total of 17 boreholes, including two re-drills and one short deflection, were completed, aggregating 13,541 ft. of drilling. Six holes penetrated to more than 1,000 ft., the deepest being 1,440 ft. The shallowest bore was drilled to a depth of 428 ft. 6 in. The boreholes have been numbered N.S. 81 to 92 inclusive, 96, 99, 104, 108, and 110.

P.D.T.S. Ltd. had recommended drilling on 18 sites on an approximate 20 chain grid but it was found practicable to drill only 13 of these. Additional bores N.S. 99 and 104 were considered necessary to delineate workable areas of coal and N.S. 89 and 92 (P.D.T.S. No. 11 Mine Area) were drilled during this campaign as it became evident that they would prove coal which could be worked from Cornwall and Blackheath No. 1 Collieries.

A topographic survey of the area was carried out by E. Cowley, Assistant Surveyor.

Underground inspection and, where necessary, sampling of coal faces was carried out in most of the working mines in the area to give additional control points for estimating reserves. Seam sections measured enabled correlations to be made with the seam sections in the boreholes.

Sections of coal seams recovered by diamond drilling were inspected by Engineer Members of the Queensland Coal Board prior to sampling.

The report is accompanied by the following plans and sections:—

Fig. 1.—A plan showing bore sites, topography and surface geology.
Fig. 1A.—Locality Plan.
Fig. 2.—A plan showing bore sites, underground workings, P.D.T.S. Mine Areas and approximate reserve areas.
Fig. 3.—Three geological cross-sections.
Figs. 4 and 5.—Generalised bore sections.
Figs. 6-10.—Detailed sections of seams from boreholes and from mine workings showing recoveries and analytical data.
Fig. 11.—Structure contour plan of Four Feet Seam.
Fig. 12.—Diagrammatic representation of relationship between Four Feet Top Coal and Four Feet Seam.

Acknowledgments.

The writer was given considerable assistance in logging bore cores by J. B. Cameron, Geologist, and with field mapping by D. C. Mengel, Assistant Geologist. The staff of both Blackheath and Bonnie Dundee Collieries were at all times ready to discuss problems and to provide any assistance required.

General Geology.

The general geological picture is one of Tertiary sediments and volcanic rocks to the east unconformably overlying gently east-dipping sediments of the Upper Triassic Bundamba Group, which in turn overlie the Mid-Triassic Ipswich Coal Measures.

An investigation of the basal portion of the Bundamba Group as revealed by surface exposures and in bore cores, showed a massive sandstone in excess of 300 ft. thick, underlain by a succession of beds with lithology similar to the Ipswich Coal Measures. The Aberdare Conglomerate is either absent in the area or is represented by isolated and very thin coarse sandstone beds.

Tertiary.

The Tertiary beds are part of the Redbank Plains Group of A. K. Denmead (1). They are characterised by soft, multi-coloured shale and mudstone interbedded with basaltic lava and ash beds which attain a thickness of 80 ft. in N.S. 96. Some siltstone and sandstone beds are found throughout the section. The sandstone varies in grain size from fine to very coarse but is invariably soft, and becomes friable after short exposure, due to its argillaceous matrix.

The Tertiary beds showed greatest development in three boreholes along Six Mile Creek, attaining a maximum thickness in N.S. 96, where approximately 500 ft. of Tertiary was drilled.

A supply of artesian water which flowed at the rate of 40 g.p.h. was encountered in fine sand in N.S. 91 at a depth of 270 ft., some 30 ft. above the base of the Tertiary strata. The bore ran continuously for several months but has since ceased.

The Tertiary-Mesozoic boundary was traced along an approximately north-south line slightly to the west of bores N.S. 89 and 104. Comparison of levels of Tertiary strata located by surface mapping and in boring confirms that Tertiary rocks were deposited on an uneven land surface. The most striking example of this is seen in bores N.S. 91 and 96 which are 16 chains apart along the strike and at approximately the same relative level. In N.S. 91 only 300 ft. of Tertiary was encountered while almost 500 ft. was drilled in N.S. 96.

Bundamba Group.

Several outcrops of medium to coarse grained sandstone with thin pebble beds which in places lie immediately to the west of the Tertiary boundary are probably the basal section of the relatively massive sandstone which characterises the uppermost elements of the Bundamba Group encountered in bores in this area. This sandstone is well represented in N.S. 108 where 250 ft. of fine, grading to coarse grained sandstone was penetrated immediately below the Tertiary strata. Where unweathered this sandstone is usually white in colour due to the majority of the grains being milky or clear quartz cemented by kaolin. The massive sandstone is underlain by approximately 400 ft. of inter-bedded fine grained sandstone, siltstone and shale with one thin carbonaceous horizon located at outcrop and a number of coal or carbonaceous shale horizons penetrated in boreholes. This section is well represented in cores from N.S. 91, 96, and 108. It is noticeable that the lithology of this basal section of the Bundamba Group is very similar to the Ipswich Coal Measures e.g. in N.S. 91 a section from 386 ft. to 776 ft. consisted of approximately 75 ft. of shale and 315 ft. of fine sandstone and siltstone. The shale is well distributed through the section. Carbonaceous shale and coal bands occurred between 678 ft. 9 in. and 681 ft.

The full succession in the Bundamba Group is nowhere represented in the area because of Tertiary erosion and subsequent deposition.

Aberdare Conglomerate.

This formation has been defined by A. K. Denmead (1, p. 6) as being made up of siliceous pebbly conglomerate and siliceous sandstone with interbedded shale and carbonaceous shale.

The equivalent section in P.D.T.S. Nos. 9 and 10 Mine Areas consists of medium grained sandstone, with some thin beds of coarse grained and pebbly sandstone which forms the crests of the ridges north-east and south-west of Blackheath No. 1 Colliery. No true conglomerate exists in the area. Boreholes down dip from the outcrop often penetrated the horizon without encountering more than a thin bed of medium grained sandstone which cannot be differentiated from other sandstones in the sequence.

Ipswich Coal Measures.

A. K. Denmead (1) described the Ipswich "Series" as extending from the base of the Aberdare Conglomerate to the bottom of the andesitic tuffs of the Kholo "Stage". He divided the "Series" into four "Stages" of which only the Blackstone and Cooneana are represented in the area under consideration.

Blackstone "Stage".

The Blackstone "Stage" is typified by interbedded shale, siltstone, sandstone and a number of coal seams and carbonaceous horizons. The sandstones are usually fine grained with coarser beds overlying the Four Feet Seam in many localities. Boring has borne out A. K. Denmead's suggestion (1, p. 14) that the Four Feet Standstone occurs on more than one horizon; in fact, it is often indistinguishable as a separate member in the bore cores (see Figs. 4 and 5).

In the Blackheath-Bonnie Dundee Area, the Blackstone "Stage", which extends from the base of the Aberdare Conglomerate equivalent to the base of the Rob Roy Seam, varies from 600 ft. thick in N.S. 89 to the north, to 900 ft. thick in N.S. 110 in the south-eastern corner. The variation in thickness is almost entirely due to a predominantly sandstone member which splits the Four Feet Top Coal from the Four Feet Seam. The Top Coal is separated from the Four Feet Seam at the top end of Blackheath No. 1 main dip by 12 ft. of shale and coal but down dip the split widens to a known thickness of 80 ft. in the workings on the two seams. In the boreholes ahead of Blackheath workings the split was 130 ft. in N.S. 91 and 225 ft. in N.S. 110.

There are in all eight named coal seams in the Blackstone "Stage" in Nos. 9 and 10 Mine Areas. Six of these seams have been worked but the three lowest in the succession, viz., Bergin (bottom section), Striped Bacon and Rob Roy Seams are inferior and unworkable. The seams vary in quality laterally and in many cases sections change rapidly from workable to unworkable. The interval between seams also varies considerably (Table A) and is rarely of any value for purposes of correlation.

Typical Ipswich fossil plants, viz. *Thinnfeldia odontopteroides*, *Ginkgo* sp., and *Cladophlebis australis*, are common in the shales and to a less extent in the siltstone beds. A fresh water crustacean (*Estheria*) was found in black shale in N.S. 88 some 50 ft. above the horizon of the Striped Bacon Seam. This occurrence of *Estheria* is at the same stratigraphical level as that found in bores in P.D.T.S. Mine Areas 7 and 8 (A. K. Denmead, 2, p. 7).

Cooneana "Stage".

The Cooneana "Stage" was reached in most of the bores drilled in the western portion of the mine area. It outcrops over a small area to the north-west (see Fig. 1).

The Rob Roy Seam is invariably underlain by a thin shale-siltstone member averaging 15 ft. in thickness which is then followed by coarse, often pebbly sandstone, typical of the Cooneana "Stage". The

maximum thickness of sandstone drilled was 250 ft. in N.S. 83. A shale, coal and siltstone sequence 120 ft. thick underlies the sandstone in this bore. No bore penetrated the full thickness of the Cooneana "Stage" as represented in the area by borehole N.S. 93, reported on by the present author (3).

Occasional thin lenticular shale horizons are interbedded with the coarse sandstone. Boring in the Cooneana "Stage" indicates the presence of four lenticular inferior coal seams none of which can be correlated (see Figs. 4 and 5).

The Coal Seams.

Represented in the area are eight named coal seams in the Blackstone "Stage", as well as a number of non-persistent coaly horizons in the beds above and below this "Stage". The seams in descending order are:—

Unnamed seams in beds above the Blackstone "Stage".
Aberdare (Top and Bottom sections).
Bluff.
Wright.
Four Feet Top Coal.
Four Feet.
Bergin (Top and Bottom Sections).
Striped Bacon.
Rob Roy.
Four unnamed seams in Cooneana "Stage".

Aberdare Seam.

One, and sometimes two coaly sections which are equivalent to the Aberdare Seam were cored in six boreholes. When two distinct coaly sections were encountered they were usually 30 ft. apart.

A distinctive light pinkish grey shale carrying numerous needles and grains of iron carbonate was found to be a particularly useful marker at about the horizon of the Aberdare Seam. Re-examination of old cores and later boring has shown that this shale extends over most of the Bundamba mining district. At outcrop the probably equivalent shale, with the iron carbonate weathered out or altered to iron oxide, is present over the Aberdare Seam at Fernie Creek Tunnel.

No workable section of Aberdare coal was recovered from any borehole, the seam usually being represented by carbonaceous shale with thin coal plies.

Bluff Seam.

The Bluff Seam was found at an average depth of 65 ft. below the Aberdare Bottom Seam, pavement to pavement (see Table A for intervals between seams).

The seam was well represented in only three boreholes, viz., N.S. 87, 88, and 110. No core was recovered from the Bluff Seam horizon in N.S. 99. In five other holes N.S. 81, 89, 90, 91, and 96 the seam was represented by a carbonaceous section reaching a maximum thickness of 5 ft. in N.S. 90. The horizon of the seam was not recognised in N.S. 92 and 104.

In N.S. 87 the seam was 21 ft. 1½ in. thick and in N.S. 88 17 ft. 7 in. thick, but in each bore the section was highly banded e.g. in N S. 87 the 21 ft. 1½ in. seam consisted of 9 ft. coal, 4 ft. 3 in. bluey and inferior coal and 7 ft. 10½ in. carbonaceous shale and shale in more than 40 bands. The fawn shale marker band of the Bluff Seam was identified in each of these boreholes.

The Bluff Seam was worked in Little Jim Mine where 2 ft. 6 in. of good quality coal was extracted in a total section of 5 ft. Two trial tunnels in the vicinity of N.S. 87 and 88 proved the seam to be unworkable in that area.

Drilling has shown that, while the Bluff Seam is present over the southern portion of the Mine Areas, it is not workable, and, furthermore deteriorates to a thin carbonaceous shale horizon and is finally missing entirely to the north.

Wright Seam.

The Wright Seam was encountered in six boreholes at an average depth of 65 ft. below the Bluff Seam. Sections which would be workable with beneficiation were penetrated in N.S. 87 and 88 but the seam deteriorated down dip and was unworkable at N.S. 99. The seam was represented by approximately 10 ft. of thinly interbedded shale, carbonaceous shale and coal plies in the three bores along Six Mile Creek viz. N.S. 91, 96, and 110, but it had disappeared completely in the northern portion of the area under investigation.

The seam is worked in Blackheath No. 5 Mine where an average section consists of 10 in. coal and coaly shale, 2½ in. shale, 3 ft. 6 in. coal, 1½ in. shale with 10 in. coal at the bottom. The seam thickness and the quality of the coal vary around the perimeter of the workings. The best coal was on the Bonnie Dundee boundary to the north, while a general deterioration down dip was evident.

To the south-east, Blackheath No. 5 workings have reached a fault parallel to the Blackheath Fault and pillar extraction will begin shortly in this pit. A new mine, No. 7, has been started at the crop of the Wright Seam, 25 chains south-east of No. 5. At the time of inspection the dip face had advanced 60 yd. and was 5 chains south-south-east of N.S. 87. The seam section analysed from N.S. 87 was only 3 ft. 5 in. thick and carried 30·3 per cent. ash. At the dip face in Blackheath No. 7 the sampled section was 4 ft. 9 in. thick and carried 37·8 per cent. ash. The high ash content was due to the inclusion in the sample of a thick shale band near the roof which later proved to be very lenticular.

In N.S. 88, which lies 16 chains slightly south of east from Blackheath No. 7, the seam was 5 ft. 1 in. thick and carried 32·6 per cent. ash. The seam section in this borehole was similar to that measured in Blackheath No. 5 Mine.

It is anticipated that a narrow strip of coal extending down dip from the crop for about 15 chains will exist for some distance south of the present workings, probably to the abandoned workings on this seam in old Bonnie Dundee No. 6 Tunnel in por. 137, parish Bundamba.

Four Feet Top Coal.

In the Blackheath-Bonnie Dundee Area the seam encountered below the Wright Seam, at depths varying from 80 ft. in N.S. 87 to 180 ft. in N.S. 91 is named the Four Feet Top Coal. This seam was penetrated by nine boreholes, but only three of these, viz. N.S. 90, 92, and 104, showed sections even approaching workability. The ash content of each section analysed was approximately 35 per cent.

The small area of coal delineated by these bores lies to the north-west of Greenwood Village and ahead of Cornwall Mine.

In some areas, e.g. in Cornwall Mine and in N.S. 90 and 92, the Four Feet Top Coal is continuous with the main Four Feet Seam. The seams split down dip as shown in Blackheath No. 1 Colliery workings and as verified by boring. Fig. 12 illustrates diagrammatically the position at which the split occurs.

Whereas in the past the name Four Feet Top Coal has been applied to the coal worked at the top of the coal-bearing section overlying the Four Feet Seam it is proposed in this report to apply the name to the coaly section that sometimes splits away from the Four Feet Seam as shown in Fig. 12.

In the bores the seam was characteristically represented by a thick banded coal section. The thickest section, in N.S. 104, contained only 6 ft. 4 in. coal and inferior coal in 29 plies in a total seam thickness of 15 ft. 2½ in. The 4 ft. 4¾ in. thick section analysed from this borehole was taken from the upper part of the seam. In N.S. 90 the seam was 11 ft. 3½ in. thick, and a section 5 ft. 10½ in. thick from the bottom portion of the seam was analysed. A similarly situated section 5 ft. 2¾ in. thick was analysed from N.S. 92.

The seam deteriorates as it splits away from the Four Feet Seam and quickly becomes unworkable. It was not present in bores N.S. 84 and 99 and even though it was present in N.S. 110 it probably loses its identity completely to the south of P.D.T.S. Nos. 9 and 10 Mine Areas.

The Four Feet Top Coal was worked in patches in Sunrise Colliery (Bonnie Dundee No. 2) and also to a very limited extent in Blackheath No. 1. It is being worked, together with the Four Feet Seam, in Cornwall Mine where the total thickness of the two seams is approximately 20 ft.

Four Feet Seam.

The interval between the Four Feet Top Coal and the Four Feet Seam varied from nil in N.S. 90 to 230 ft. in N.S. 110, where the sandstone member splitting the two seams reached its maximum thickness.

The Four Feet Seam was encountered in twelve boreholes and was workable in all except one, N.S. 88, in which the weighted ash content of a section 3 ft. 5½ in. thick was 39·6 per cent. The seam thickness varies from 3 ft. 0 in. in N.S. 86 and 87 to 8 ft. 2½ in. in N.S. 92. The average thickness for all boreholes is 5 ft. 6½ in.

The seam is readily divisible into three distinct sections. The top section is always inferior and overlies a prominent fawn shale band which is distinguished by the "leathery" parting at its base. This section is worked in Cornwall Mine but only because the Four Feet Top Coal and Four Feet Seam are mined as one. It averages 3 ft. 8 in. in thickness with 9 in. of shale at the bottom.

Between the "leathery" parting and the "double white" shale marker is a coaly section, approximately 3 ft. 0 in. thick, the bottom 1 ft. 2 in. of which was designated as the "brushing band" (A. K. Denmead 1, p. 26). Of this section less than 1 ft. 0 in. of coal at the bottom is considered of workable quality in boreholes in the southern portion of the area. In Blackheath No. 1 Colliery the bottom 1 ft.-2 ft. of coal with several lenticular shale bands is worked, while in the northerly bores and Cornwall Mine workings a section up to 3 ft. 4 in. thick is workable.

Below the "double white" marker bands the main Four Feet Seam varies in thickness from 3 ft. 0 in. in N.S. 86 and 87 to 4 ft. 6 in. in N.S. 92. The present working thickness of this section in Blackheath No. 1 Colliery averages 3 ft. 7 in. as compared with a thickness of 4 ft. 3 in. worked in the upper levels. As N.S. 89 showed some deterioration in the quality of the coal in the main Four Feet Seam it is probable that development on the seam in the north will parallel the gradual down dip deterioration in quality encountered in Blackheath No. 1 Colliery.

The drilling programme has further demonstrated the deterioration of the Four Feet Seam to the south. The actual line of deterioration is irregular but trends in a general south-easterly direction (see Fig. 2). Blackheath No. 6 Mine lies near the southern limit of workable coal in the Four Feet Seam as marked deterioration in the quality of the coal occurs in short levels on the right hand side of the mine.

Three bores along Six Mile Creek, N.S. 91, 96, and 110, showed the Four Feet Seam to be workable and improving in thickness and quality to the north. It was in these three boreholes that the Bergin Seam was found immediately below the Four Feet Seam giving a total thickness of workable coal that averages 11 ft. 6 in., excluding a 1 ft. 9 in. "badger" between the two seams (see Tables B).

In borehole N.S. 81 a relatively clean coal seam was encountered at 850 ft. The structure contour map of the Four Feet Seam in the area (Fig. 11) shows that this seam occurs at the expected horizon of the Four Feet Seam, but there the similarity ends. The distinctive marker bands usually associated with the Four Feet Seam were not apparent in the core recovered but this may have been due to broken core

being mixed in the barrel. A very coarse sandstone immediately overlying the seam suggests erosion with loss of marker bands. In either case there has been alternatively very local thickening of the Four Feet Seam or the Bergin Seam has merged with the Four Feet Seam sooner than anticipated in the area, and without the intervening "badger" found in bores along Six Mile Creek.

Bergin Seam (Top Section).

The Bergin Seam is split into two sections throughout the Mine Areas except as shown in N.S. 91. The top section, penetrated in 10 boreholes, is separated from the Four Feet Seam by a maximum interval of 30 ft. (pavement to pavement) in N.S. 87 and 88. In a number of bores the Four Feet and Bergin Seams are contiguous, while in others the maximum thickness of shale between them is 10 ft. It was found that as the Four Feet and Bergin Seams came closer together the coal in the latter improved in thickness and quality.

Boring has shown that the seam does not exist in the northern portion of the area; that it exists as a thin coaly shale horizon in the south-west, and that it is present as a workable seam to the south-east (see Table B). Here in N.S. 110, the maximum workable seam thickness is 10 ft. 5 in.

The seam is worked in parts of Sunrise Colliery where it has an average thickness of 4 ft. 9 in. of which 6 in. is shale in four thin beds. The seam where worked in Sunrise is separated from the Four Feet Seam by 3 ft. of shale. This shale bed thickens to the east, with deterioration of the Bergin Seam which has not been located by shallow exploration in Blackheath No. 1 Colliery. As the main dip in this colliery is nearing Six Mile Creek it is anticipated that the Bergin Seam soon will be located at a shallow depth under the present floor and will prove to be a working proposition.

Bergin (Bottom Section).

At intervals varying from 110 ft. to 125 ft. beneath the Bergin top section, the bottom split of the Bergin Seam was intersected in six boreholes along the western portion of the drilled area. In N.S. 87 and 88 the bottom section was represented by only a few inches of carbonaceous shale and coal bands. The section was well developed in N.S. 82, 83, and 85, where it was represented by 10 ft. of interbedded coal, carbonaceous shale and shale. In N.S. 83 a banded section 6 ft. 8 in. thick containing 5 ft. 0 in. of coal and 1 ft. 8 in. shale was the nearest approach to a workable section penetrated in the area. In bores N.S. 91 and 96 in the eastern part of the area, a banded shale and carbonaceous shale horizon 8 ft. 0 in. thick, assumed to be the Bergin bottom section was found immediately below the top section.

Four chains north of Sunrise tunnel entrance an old shaft was reported as being 35 ft. deep to the Striped Bacon Seam. Mapping has shown that this shaft sunk to the Bergin bottom section.

Striped Bacon Seam.

This seam and the underlying Rob Roy Seam were identified in each of the nine boreholes drilled to sufficient depth to reach them. The Striped Bacon Seam in every instance was represented by a succession of coal and shale bands varying in total thickness from 5 ft. to 12 ft. and nowhere presenting a section approaching workability. The seam lies 100 ft. under the Bergin bottom section. Over most of the area it has no distinctive marker band but the stratigraphical relationship between it and the Rob Roy Seam is so constant that it leaves no doubt as to the identity of the Striped Bacon Seam when both seams are encountered.

The seam worked in Noblevale No. 1 Colliery No. 3 Tunnel was considered by A. K. Denmead (1, p. 88) to be the middle portion of the Four Feet Seam. This assumption was based mainly on the occurrence in the seam of a yellow shale band with a "leathery" parting at the base which is similar to a shale band found in the measures above the main Four Feet Seam. N.S. 92 penetrated a section in the Striped Bacon Seam which also carried a light grey-fawn shale band with a "leathery" band at the bottom. This same band has been found in further drilling on P.D.T.S. No. 11 Mine Area and there can now be no doubt that the seam worked from Noblevale No. 1 Colliery No. 3 Tunnel was the Striped Bacon Seam.

For the purpose of comparison the seam sections penetrated in N.S. 92 and measured by A. K. Denmead in No. 3 Tunnel are as follows:—

Noblevale No. 1, No. 3 Tunnel—	ft.	in.
Coal	0	5
Shale	0	1
Coal	0	6
Stone	0	1
Coal (with lenticular stone band)	0	7
White stone	0	2
Coal	0	4
Yellow stone (with "leathery" parting)	0	3
Inferior coal	0	2
Stone	0	1
Coal (with lenticular stone band)	1	8
N.S. 92, Striped Bacon Seam—	**ft.**	**in.**
Black shale	0	8
Fawn shale	0	0¾
Coal	0	6¾
Fawn shale grading to medium grey shale	0	1½
Coal (part broken core)	0	4¼
Light grey shale	0	1¾
Inferior coal	0	4¼
Light grey shale with "leathery" band in bottom 1 in.	0	4
Carbonaceous shale with coal laminae	0	0¾
Light grey shale	0	1
Coal with ¼ in. medium grey shale 7¾ in. from top	1	10¾

With the exception of the top band it will be seen that the seam sections are almost identical both in distribution and thickness of coal plies and shale bands.

A thin but persistent coaly horizon occurred midway between the Bergin Seam (bottom section) and Striped Bacon Seam in N.S. 82, 83, 84, 85, 87, and 88. This horizon is situated immediately under the *Estheria* shale found in N.S. 88.

Rob Roy Seam.

This, the lowest seam of the Blackstone "Stage", was found 30 ft. below the Striped Bacon Seam. It was usually underlain by 15 ft. to 20 ft. of shale and siltstone followed invariably by typically coarse to pebbly sandstone of the Cooneana "Stage."

The Rob Roy Seam was best developed in the vicinity of N.S. 83, 84, 85, and 88 where it was represented by from 6 ft. to 12 ft. of coal and shale bands in approximately equal proportion, which in no case constituted a workable section.

Unnamed Seams in Cooneana Formation.

A coaly horizon was encountered in four boreholes at depths of from 50 ft. to 290 ft. below the Rob Roy Seam. As none of these seams persisted from bore to bore and none was workable, they are of no importance.

Structural Geology.

Folding.—The controlling structure in the area is the Bundamba anticline, the axis of which strikes north-north-west and regionally pitches south. There is a local reversal of axial pitch to the west of Blackheath No. 1 Colliery. This pitch change causes the outcrops of the Four Feet and underlying seams to swing sharply from a north-south to an east-west trend. The outcrops of the Aberdare, Bluff and Wright Seams reflect the pitch change in a strong flexure to the west.

A parallel fold brings Mesozoic rocks to the surface in an anticlinal crest to the east of Six Mile Creek. The intervening synclinal axis probably lies to the east of Six Mile Creek as structure contours indicate easterly dips in N.S. 91, 96, and 110 at approximately 12 deg. (see Fig. 11). The dips in the bottom 100 ft. of N.S. 96, the most easterly borehole, average only 5 deg., which suggests the possibility of an asymmetrical synclinal trough with a west dipping axial plane.

The regional dip in the mine area averages 10 deg. east.

Topography, rather than structure, explains the sinuous nature of the outcrops of many of the coal seams.

Faulting.—Two named faults, the Blackheath and Noblevale Faults, dislocate the seams in the central and northern parts of the area respectively. The Blackheath Fault is a west dipping normal fault with an average dip of 45 deg. and a throw of 60 ft. in Blackheath No. 1 Tunnel. A. K. Denmead (1, p. 18) states that the throw increases to 150 ft. at a point behind Blackheath No. 2 Tunnel but this figure seems excessive in the light of detailed mapping done for this report. The maximum suggested by surface mapping is 40 ft. with a fairly rapid diminution to the south.

A fault met in the south-east crossdip in Blackheath No. 5 Colliery is probably one of the faults paralleling the main Blackheath Fault, examples of which can be seen in Bonnie Dundee Four Feet Seam workings. Displacements on these faults in Bonnie Dundee No. 2 are reported to aggregate less than 20 ft., indicating a rapid decrease in throw on the Blackeath Fault to the north of Blackheath No. 1 Tunnel. The colliery plan of the Fernie Creek workings shows no faulting at the projected position of the Blackheath Fault.

A parallel normal fault 40 chains east of the Blackheath Fault has been encountered in both the Aberdare and Four Feet Seam workings in Blackheath No. 1 Colliery. This fault strikes north-north-east and has a down throw of from 10 ft. to 20 ft. to the north-west.

The Noblevale Fault, an extensive reverve fault striking west-north-west along a line parallel to and just north of Redbank Plains Road is known only from mine workings (A. K. Denmead, 1). It dips to the north-north-east and has a calculated displacement of 20 ft. near N.S. 92, increasing to the south-east.

A fault dipping at 40 deg. to the east-south-east stopped development on the Striped Bacon Seam in Noblevale No. 1 Colliery, No. 3 Tunnel. Four Feet Seam workings from Noblevale No. 1 Colliery lie ahead of this fault but since exact relative levels on the Four Feet Seam workings are not available the vertical displacement on the fault is not known. However, reference to cross-section A–A′ (Fig. 3) indicates a down throw of 150 ft. + to the south-east. A study of the plans of Noblevale No. 1 Colliery and No. 3 Tunnel workings indicates that the fault separating the two must follow a curved course swinging from north-north-west to south-south-west around the limits of the workings. The fault may then sweep across to a fault dipping at 40 deg. east exposed in the railway cutting east of the Redbank Plains Road overbridge.

The structure contour map of the Four Feet Seam (see Fig. 11) indicates another major fault in virgin ground east of Cornwall Mine. This fault could be an easterly extension of any one of a number of minor west-north-west faults encountered in the southerly Four Feet Seam workings of Noblevale No. 1 Mine. An upthrow of 100 ft. to the north is indicated along this postulated fault or series of faults.

Coal Evaluation.

Almost without exception efficient drilling techniques resulted in a very high percentage core recovery both in coal seams and in the intervening strata. A re-drill or deflection through a seam resulted in a satisfactory recovery in the few cases in which the initial core recovery was low. The average recovery in workable coal seams was slightly above 98 per cent. so that ash values quoted in this report will be very close to those obtained in mining.

The fixed carbon content of the coal, calculated on a dry-mineral-matter-free basis using the Parr formula, varies from 61·2 per cent. to 67·8 per cent. for all seams, with an average of 62·8 per cent. This places the coal in the high volatile bituminous group.

The average fixed carbon content of the different seams shows some variation.

The Wright Seam has higher values than usual, showing a variation between 65·9 per cent. and 67·8 per cent. and giving an average value of 66·8 per cent. on the results of four samples.

The Four Feet Top Coal and Four Feet Seams showed little difference. In the Top Coal fixed carbon content ranged from 59·4 per cent. to 64·2 per cent. with an average of 62·4 per cent. (eight samples) while the Four Feet Seam values ranged from 61·3 per cent. to 64·0 per cent. with an average of 62·7 per cent. (nineteen samples). The range in the Bergin Seam was from 62·6 per cent. to 64·8 per cent. with an average value of 63·9 per cent. based on five samples.

The moisture content averaged 2·0 per cent. and varied little from this value in all seams.

Sulphur content ranged from 0·19 per cent. to 0·42 per cent. with a mean of 0·26 per cent. in the Four Feet Seam. In the Wright Seam values ranged from 0·27 per cent. to 0·29 per cent. with an average of 0·28 per cent. Corresponding values in the Four Feet Top Coal were from 0·19 per cent. to 0·35 per cent. with an average of 0·28 per cent. and in the Bergin Seam values ranged from 0·17 per cent. to 0·29 per cent., averaging 0·23 per cent.

The calorific value of coal carrying 25 per cent. ash is approximately 10,500 B.T.U. per lb.

Washability Tests.

The initial decision to restrict washability tests to those samples carrying apparent high ash values, and to sample some stone bands separately, has meant that insufficient data are available to present complete determinations of washing tests on all seams. Appendix I. gives the results of those tests which have been carried out.

Some apparently anomalous values obtained from washability tests can perhaps be attributed to the fine grinding necessary to obtain a representative sample from bore cores. The overall results should be a fair indication of the effect washing at 1·8 specific gravity would have on a seam, but some individual sample figures may not give a true indication of results to be expected in practice.

A rough estimate of average washability values from all seams tested shows that a final product carrying 20 per cent. ash necessitates discarding 25 per cent. of the mined coal during washing at specific gravity 1·8.

Wright Seam weighted average values from only four samples show that at a specific gravity of 1·8, floats with an ash value of 19·8 per cent. make up 77·5 per cent. of the whole. The complete range of floats at specific gravity 1·8 is 69 per cent. to 85·7 per cent. while the weighted ash values range from 18·5 per cent. to 21·2 per cent.

In the Four Feet Top Coal a discard of 31·4 per cent. during washing results in a product carrying 20 per cent. ash. Discard percentages range from 16·3 to 39·6 while the ash values of the floats range from 15·7 per cent. to 24 per cent. (eight samples).

Table C shows that in those cases in which washability tests were carried out on sections of the Four Feet Seam the percentage of floats at specific gravity 1·8 ranged from 68·9 to 82·9 and the ash values varied between 17·8 per cent. and 21·5 per cent. Establishing a weighted average for the values from these samples it is found that 78·3 per cent. floats at specific gravity 1·8, and the ash value is 18·7 per cent. Many Four Feet Seam samples carried less than 25 per cent. ash and accordingly were not subjected to washability tests. Had all samples been washed the percentage discard would have been lower than the 21·7 indicated.

Coal Reserves.

In calculating coal reserves an arbitrary five chain limit beyond the outside boreholes has been imposed on workable coal. When a seam approached the limits of workability this 5 chain boundary was decreased. The limits of workability were arbitrarily selected as a maximum ash value of 30 per cent. and a minimum thickness of 2 ft. 6 in. for unwashed coal. Estimates are based on 100 per cent. extraction over the whole area which is rarely possible in practice.

Reserves have been calculated (*a*) for coal which is marketable only after washing at specific gravity of 1·8 (with a maximum ash value of 25 per cent. on the floats), and (*b*) for unwashed coal.

Measured reserves have been calculated in category (*a*) for the Wright and Four Feet Top Coal Seams and in category (*b*) for the Four Feet Seam. Reserves of coal exist in the Bergin Top Seam, but the seam is workable only in patches and no measured reserves could be calculated.

1. *Wright Seam.*—Measured reserves of coal in category (*a*) are based on a mean seam thickness of 4ft. 8 in. with specific gravity of 1·596. Of this 22·5 per cent. is discarded to give an ash value of 19·8 per cent. and specific gravity of 1·466. The area in which reserves have been calculated is 34·4 acres.

Estimated measured reserves, i.e. actual mineable tonnage is calculated at 310,000 tons of which 220,000 tons is estimated to be marketable after washing at specific gravity 1·8.

No reserves exist in category (*b*).

2. *Four Feet Top Coal.*—Measured reserves in this seam are calculated only for coal in category (*a*). The seam sections analysed averaged 7 ft. 11 in. in thickness (on four samples only), with a weighted ash value of 36·6 per cent. and a specific gravity of 1·633. On washing at specific gravity 1·8, the floats amounted to 66·8 per cent. of the whole which reduced the effective seam thickness to 5 ft. 3½ in. approximately. This washed coal had a specific gravity of 1·438 and a weighted ash content of 19·5 per cent.

Measured reserves stand at 697,000 tons of which an estimated 410,000 will be marketable after washing at specific gravity 1·8.

3. *Four Feet Seam.*—Measured reserves exist over 418·9 acres in the Four Feet Seam. The seam thickness, calculated from fifteen bore and mine samples, averages 5 ft. 6½ in., while the weighted ash content is 25·90 per cent. and specific gravity 1·506. The deepest workable section was under 1,370 ft. of cover in N.S. 110.

Measured reserves in category (*b*) are estimated at 4,230,000 tons.

There is every indication of reserves of Four Feet Coal in the area east of N.S. 81—N.S. 89 but additional drilling is necessary to prove the extent of the seam in this direction.

4. *Bergin Seam.*—As indicated earlier in this report the Bergin Seam is workable in N.S. 91, 96, and 110 but as these bores are colinear no reserves can be estimated. Nevertheless it must be kept in mind that considerable additional coal will be available in Blackheath No. 1 Colliery when the Four Feet workings advance some 20 chains to the position of the boreholes along Six Mile Creek.

The Bergin Seam will undoubtedly yield more coal from the present workings in Sunrise Colliery but high ash values will persist in general and workings will be patchy. No reserves can be calculated.

Conclusion.

Measured reserves of over 4 million tons exist in the Four Feet Seam with every likelihood of considerable additional reserves with an extension of drilling to the north and east. The increased tonnage due to the workability of the Bergin Seam together with the Four Feet Seam along Six Mile Creek could also be very considerable but cannot even be indicated without further drilling to the east.

Small tonnages will be mined from both the Wright and Four Feet Top Coal Seams but in each case the seam deteriorates down dip, limiting workings in that direction.

References.

1. DENMEAD, A. K., 1955—"The West Moreton (Ipswich) Coalfield," G.S.Q. Pub. No. 279 (to be issued).

2. DENMEAD, A. K., 1955—"Coal Resources, West Moreton (Ipswich) Coalfield," Parts 1 and 2, G.S.Q. Pub. No. 280.

3. HAWKINS, B. W., 1956—"Ipswich Borehole N.S. 93, Cooneana Estate," Q.G.M.J. March 1956, p. 214-219.

APPENDIX I.

Table of Washability Test Percentages.

Seam	Wright.				Four Feet Top Coal.							
Bore No.	N.S. 87.	N.S. 88.	Blackheath. No. 5.	Blackheath. No. 7.	N.S. 90.	N.S. 92.	(c) N.S. 92.	N.S. 104.	Cornwall Mine.		Blackheath No. 1.	
Sample No.	1/55.	216/54.	530/55.	531/55.	64/55.	226/54.	229/54.	65/55.	233/56.	234/56.	138/56.	139/56.
Ash (on original sample)	30·3	32·6	29·2	37·8	35·4	24·2	38·2	40·2	38·0	35·9	38·7	37·0
Floats at 1·4 sp. gr.	20·8	27·4	35·6	23·1	39·6	51·0	33·9	21·8	18·6	26·2	34·7	30·1
Ash	9·1	6·2	8·2	8·4	7·4	6·9	7·6	8·7	8·7	10·0	12·3	11·4
Floats at 1.6 sp. gr.	52·8	36·5	35·9	37·6	24·0	20·9	19·9	31·3	34·5	26·9	25·0	24·3
Ash	21·5	20·7	23·2	24·1	22·7	21·9	23·2	21·7	20·4	23·2	27·8	28·4
Floats at 1·8 sp. gr.	12·1	12·7	7·5	8·3	14·3	11·8	11·6	16·3	7·3	8·4	9·0	7·0
Ash	38·5	41·0	43·0	43·7	43·0	42·4	43·8	49·0	39·2	42·9	44·6	42·7
Sinks at 1·8 sp. gr.	14·3	23·4	21·0	31·0	22·1	16·3	34·6	30·6	39·6	38·5	31·3	38·6
Ash	66·2	72·3	72·9	71·5	72·5	66·1	72·9	72·8	73·2	69·9	71·6	65·9

Seam	Four Feet.									Bergin Top.	
Bore No.	N.S. 86.	N.S. 87.	N.S. 89.	(a) N.S. 90.	N.S. 90.	(a) N.S. 92.	(ab) N.S. 96.	(a) N.S. 104.	N.S. 110.	(b) N.S. 96.	N.S. 110.
Sample No.	63/55.	215/54.	220/54.	223/54.	225/54.	231/54.	549/54.	66/55.	67/55.	555/54.	68/55.
Ash (on original sample)	29·5	26·7	20·7	24·3	17·4	33·6	32·5	32·8	19·7	21·5	29·9
Floats at 1.4 sp. gr.	39·0	41·2	52·9	45·0	68·3	35·7	47·1	42·0	56·9	61·1	44·7
Ash	9·7	7·8	7·5	7·0	6·0	6·9	6·9	7·2	8·4	6·4	7·8
Floats at 1·6 sp. gr.	27·8	31·8	24·9	30·7	18·7	23·1	21·7	21·7	28·4	15·8	26·0
Ash	25·5	23·9	21·8	23·8	22·0	23·3	22·8	23·2	24·0	20·6	25·0
Floats at 1·8 sp. gr.	14·6	9·9	10·1	8·6	6·4	10·1	12·9	13·0	9·4	11·1	11·6
Ash	45·2	45·8	43·3	46·2	42·6	45·0	47·9	43·2	44·1	45·1	46·5
Sinks at 1·8 sp. gr.	18·6	17·1	12·1	15·7	6·6	31·1	18·3	23·3	5·3	12·0	17·7
Ash	68·5	67·5	65·2	72·8	61·8	71·1	71·0	74·5	65·8	63·2	72·2

(a) Sample represents the brushing bands.

(b) Sample was screened to + and −14 B.S. sieve and only the +14 fraction was used for washability tests. The −14 fraction constituted 37·6 per cent. of the whole and carried 21·0 per cent. ash.

(c) The banded section between the Top Coal and brushing bands—included in Top Coal for practical purpose.

TABLE A.

Showing Intervals Between Seam Pavements.

Borehole.	B. 1.	N.S. 82.	N.S. 83.	N.S. 84.	N.S. 85.	N.S. 87.	N.S. 88.	N.S. 89.	N.S. 90.	N.S. 91.	N.S. 92.	N.S. 96.	N.S. 99.	N.S. 104.	N.S. 110.	Average.
	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.	Ft.
Aberdare Top–Aberdare Bottom	30	..	..	..	..	..	..	50	40	35	..	60	..	40	80	50
Aberdare Bottom–Bluff	20	..	..	..	..	..	..	60	70	40	..	45	..	..	100	65
Bluff–Wright	120	..	..	..	..	70	70	..	..	75	..	60	..	..	60	65
Wright–Four Feet Top Coal	105	..	..	..	..	80	110	X	X	180	X	..	165	..	135	Varies
Four Feet Top Coal–Four Feet	15	..	..	X	..	70	80	40	10	130	12	X	55	20	230	Varies
Four Feet–Bergin Top	..	..	..	25	..	30	30	..	..	15	..	12	10	12	15	22
Bergin Top–Bergin Bottom	..	..	..	125	120	X	120	X	X	20	X	15	..	..	..	120/20
Bergin Bottom–Striped Bacon	..	100	100	100	100	..	95	X	X	100	X	..	..	..	..	100
Striped Bacon–Rob Roy	..	35	30	15	20	..	30	25	25	45	35	..	..	..	..	30

X = upper seam wanting in borehole.

B.1. Section measured in stone drive in Blackheath No. 1 Colliery.

TABLE B.

SHOWING VARIATION IN FOUR FEET-BERGIN SEAMS IN SIX MINE CREEK BORES.

Section.	N.S. 110.		N.S. 91.		N.S. 96.	
	Thickness.	Ash.	Thickness.	Ash.	Thickness.	Ash.
	Ft. in.	Per cent.	Ft. in.	Per cent.	Ft. in.	Per cent.
Brushing Band	0 8(*a*)	(included in F.F.)	1 1¼	32·0	2 5	32·5
Double White	0 2¾	79·2	0 6¼	65·3	0 5	80·9
Main Four Feet	2 10	19·7	3 2¼	15·4	3 7¼	13·0
Four Feet Seam-Total	3 11½	23·2	4 9¾	25·0	6 5¼	24·7
Badger	1 7	..	1 8	..	1 11½	..
Bergin Seam	4 7¼	29·3	3 7¼	19·6	3 0	21·5
Bergin Seam	5 9½	29·9	6 3¾(*b*)	41·0	9 1	unworkable

(*a*) 8 in. coal analysed with 2 ft. 10 in. of main F.F. seam.
(*b*) Top 3 ft. 6 in. of this 6 ft. 3¾ in. coal was of better quality than the remainder.

TABLE C.

SHOWING WEIGHTED ASH VALUES OF THE FLOATS FROM WASHAIBLITY TESTS.

Seam	WRIGHT.				FOUR FEET TOP COAL.					
Bore No. N.S.	87.	88.	Mine Workings.		90.	92.	92.	104.	Cornwall Mine.	
G.S. No.	1/55.	216/54.	530/55.	531/55.	64/55.	226/54.	229/54.	65/55.	233/56.	234/56.
Ash per cent, unwashed sample	30·3	32·6	29·2	37·8	35·4	24·2	38·2	40·2	38·0	35·9
Per cent. floats @ 1·8	85·7	76·6	79·0	69·0	77·9	83·7	65·5	69·4	60·4	61·5
Weighted ash per cent. of floats @ 1·8 ..	20·9	19·3	18·3	21·2	18·7	15·7	18·8	24·0	18·9	20·4

Seam	FOUR FEET TOP COAL.		FOUR FEET.					BERGIN.
Bore No. N.S.	Blackheath No. 1.		86.	87.	92.	96.	104.	110.
G.S. No.	138/56.	139/56.	63/55.	215/54.	231/54.	549/54.	66/55.	68/55.
Ash per cent. unwashed sample	38·7	37·0	29·5	26·7	33·6	32·5	32·8	29·9
Per cent. floats @ 1·8	68·7	61·4	81·4	82·9	68·9	81·7	76·7	82·3
Weighted ash per cent. of floats @ 1·8	22·4	21·9	21·5	18·5	18·0	17·8	17·8	18·6

A. H. TUCKER, Government Printer, Brisbane.

FIG.1

DEPARTMENT OF MINES · QUEENSLAND

Geological Map

P.D.T.S. Nos. 9 & 10 Mine Areas
BLACKHEATH - BONNIE DUNDEE
IPSWICH COALFIELD

County of Stanley

Showing P.D.T.S. mine areas, geology, topography and boreholes

To accompany report by B.W. Hawkins B.Sc, Geologist.

Survey by Ewan Cowley Asst. Surveyor.

SCALE OF CHAINS 10 8 6 4 2 0 10 20

SURVEY DATA

Elevations on State Datum - Grid of 20 chain co-ordinates.
Meridian of grid is true North at origin an arbitrary point being bolt in concrete block on road near angle in Eastern bdy. of sub.1, por. 213, parish of Ipswich.

EXPLANATION

Diamond drillhole ◎ NS6 — Percussion drillhole ○ Bore 6(P) — Shaft
Adit — Colliery BLACKHEATH — Colliery (abandoned) WALLSEND A
Surface contour — 60 — Coal seam at surface
Outcrop — Section line A — A'
Established boundary posn. accurate
" " " approximate
Inferred probable or indefinite boundary
Established fault posn. accurate
" " " approximate
Inferred probable or indefinite fault
Alluvium
Tertiary Basalt
Tertiary Sediments
Bundamba Sandstone
Aberdare Conglomerate
Ipswich Coal Measures
Blackstone "Stage"
Cooneana "Stage"

J.S.D. 22-2-57

BLACKHEATH - BONNIE DUNDEE AREA

LOCALITY MAP

FIG. 1A

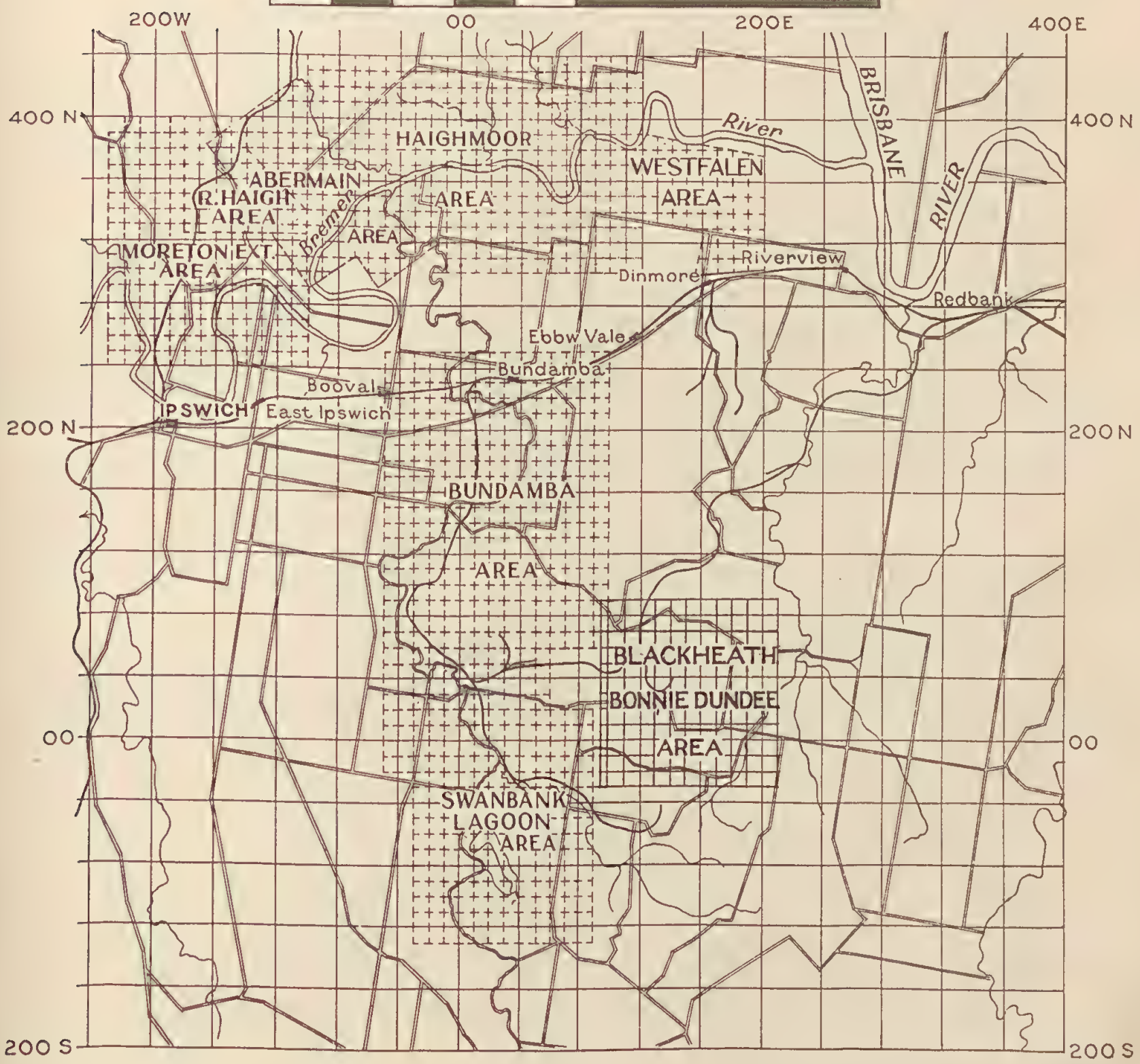


FIG. 2

DEPARTMENT OF MINES · QUEENSLAND
PLAN OF

P.D.T.S. Nos. 9 & 10 Mine Areas
BLACKHEATH ~ BONNIE DUNDEE
IPSWICH COALFIELD

County of Stanley

Showing P.D.T.S. Mine Areas, boreholes, mine workings and areas within which reserves have been estimated.

To accompany report by B.W. Hawkins B.Sc, Geologist.

Survey by Ewan Cowley Asst. Surveyor.

SCALE OF CHAINS
10 8 6 4 2 0 10 20

SURVEY DATA

Elevations on State Datum · Grid of 20 chain co-ordinates
Meridian of grid is true North at origin an arbitrary point being bolt in concrete block on road near angle in Eastern bdy of sub 1, por. 213, parish of Ipswich.

EXPLANATION ·

Colliery working BLACKHEATH
" abandoned WALLSEND A
Adit
Shaft
Diamond drillhole ◎ NS.104
Percussion drillhole Bore 6(P)

Workings on Aberdare Seam
" " Bluff "
" " Wright "
" Four Feet Top Coal
" Four Feet Seam
" Bergin Top "
" Striped Bacon "

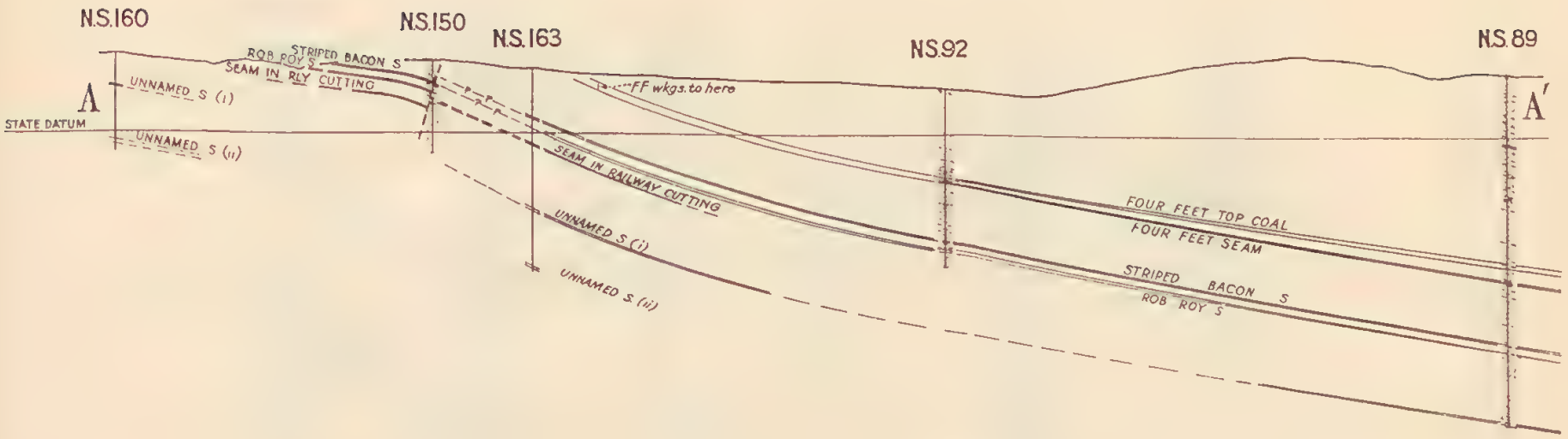
Boundaries of calculated reserves shown thus:–
Wright Seam
Four Feet Top Coal
Four Feet Seam

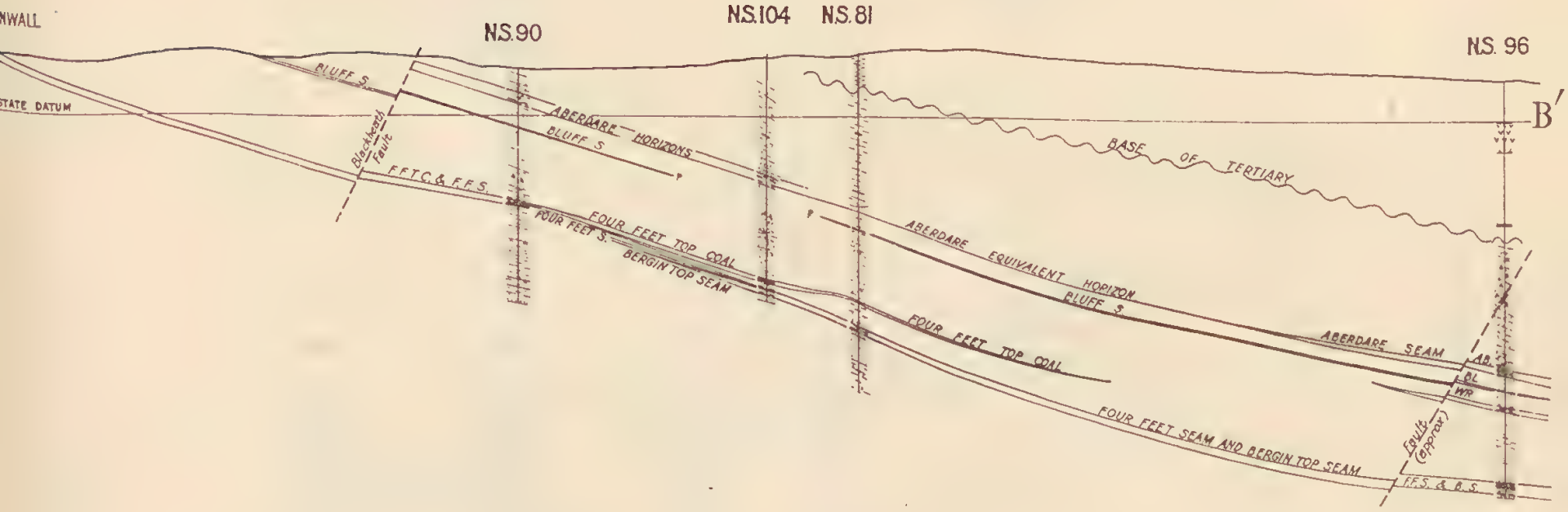
Section line A ——— A'
Samples taken in mine workings ⊗ F.F.2

NOBLEVALE No 1 A
No 3 Tunnel
NOBLEVALE
FAULT
A
NS.160/1957
R.L collar 233.12
R.L surf. 232.05
R.L. btm –39.63
NS.150/1956
R.L collar 215.55
R.L surf. 214.25
R.L. btm –56.95
NS.163/1957
R.L collar 193.28
R.L surf. 191.88
R.L. btm –401.48
NS.92/1954
R.L collar 139.77
R.L surf. 138.80
R.L btm –392.23
A'
NS.89/1954
R.L collar 191.44
R.L surf 189.44
R.L. btm –858.56
80 N
Fernie Ck.
328'
Blackheath No.1 D.D.
(approx. posn)
NS.82/1954
R.L collar 142.11
R.L surf 140.28
R.L btm –286.39
B
Red bank Plains Road
60 N
E S CORNWALL
F.F.T.C.4
F.F.7
F.F.6
J S D 25-9-57
R.L collar 198.92
R.L surf 197.02
R.L. btm –396.68
NS.83/1954
ARCHIBALD & HUNTER (A) TUNNEL
REID & ARCHIBALD (A) TUNNEL
SUNRISE
NS.104/1954
R.L collar 204.50
R.L surf. 201.78
R.L btm –566.00
NS.90/1954
R.L collar 152.2
R.L surf 150.36
R.L btm –577.37
NOBLEVALE No 4 A
NS.81/1954
R.L collar 200.2
R.L surf. 199.07
R.L btm –848.81
40 N
P.D.T.S. No.10 MINE AREA
F.F.T.C.3
F.F.4
& B1
Sections measured 15 chains down cross dip
B.2
F.F.5
FERNIE Ck. A
FAULT IN FOUR FEET SEAM
BLACKHEATH FOUR FEET SEAM
FAULT SEAM
Greenwood
Village
P.D.T.S. No.9 MINE AREA
NS.96/1954
R.L collar 130.49
R.L surf. 127.39
R.L btm –1159.18
B'
BLACKHEATH No.1
F.F.T.C.2
F.F.T.C.1
NS.85/1954
R.L collar 167.05
R.L surf 159.67
R.L btm –312.53
LITTLE JIM A
BLACKHEATH No.5
20 N
F.F.1
F.F.2
NS.91/1954
R.L collar 131.48
R.L surf 124.58
R.L btm –1311.47
W1
BLACKHEATH No.2 A
NS.87/1954
R.L collar 342.93
R.L surf 340.43
R.L btm –159.40
F.F.3
FAULT IN FOUR FEET SEAM IN ABERDARE
Six Mile Ck.
BLACKHEATH No.6
W2
BLACKHEATH No.7
00
NS.99/1954
R.L collar 199.03
R.L surf 196.73
R.L. btm.
NS.86/1954
R.L btm 93.2
C
NS.84/1954
R.L collar 253.25
R.L surf. 253.21
R.L. btm. –360.25
NS.88/1954
R.L collar 273.31
R.L surf. 271.41
R.L. btm. –408.94
Blackheath No.2 D.D.
(approx. posn.)
20 S
BLACKHEATH No.4 A
Horse Tunnel
NS.110/1955
R.L collar 205.90
R.L surf. 202.21
R.L btm –1220.26
NS.108/1954
R.L collar 205.41
R.L surf. 201.65
R.L. btm –805.93
C'
No.5 TUNNEL
BONNIE DUNDEE No.1 A
No.3 TUNNEL
100 E
120 E
160 E
180 E
200 E

P.D.T.S. Nos. 9 & 10 Mine Areas
BLACKHEATH – BONNIE DUNDEE
CROSS SECTIONS

SCALE OF CHAINS
10 8 6 4 2 0 10 20
J.S.D. 22·2·57





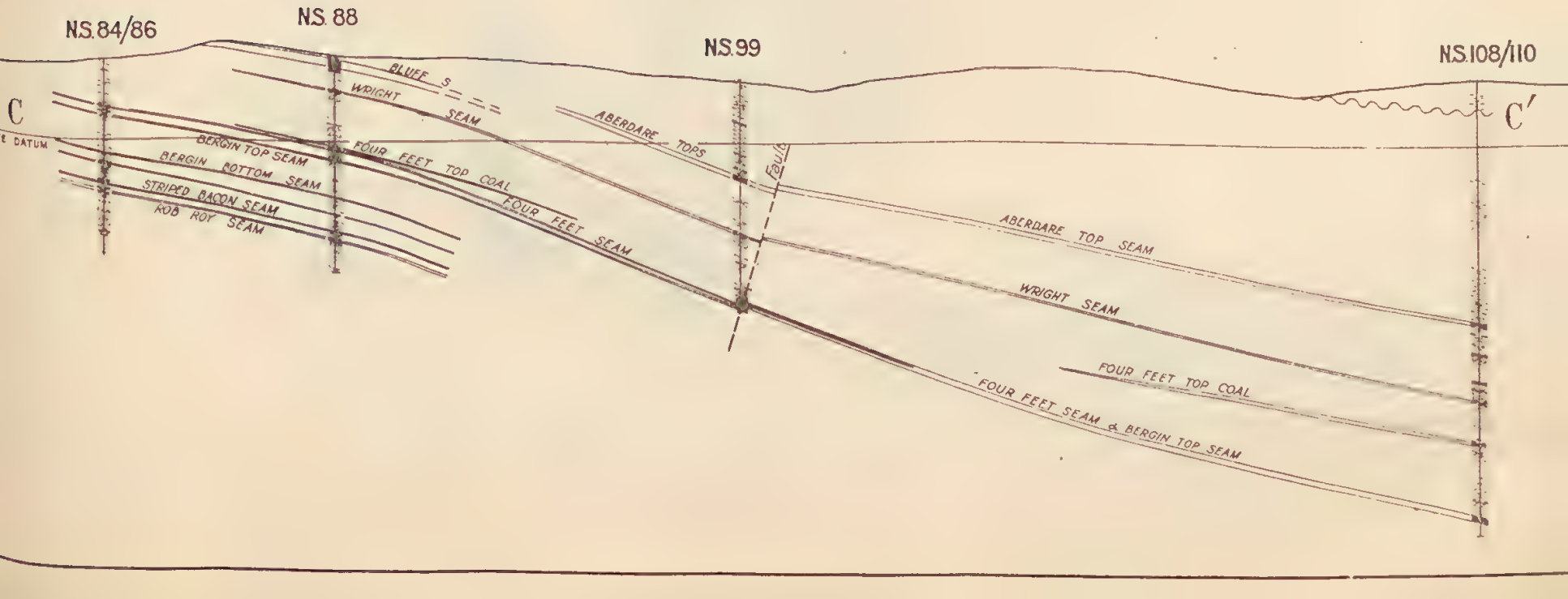
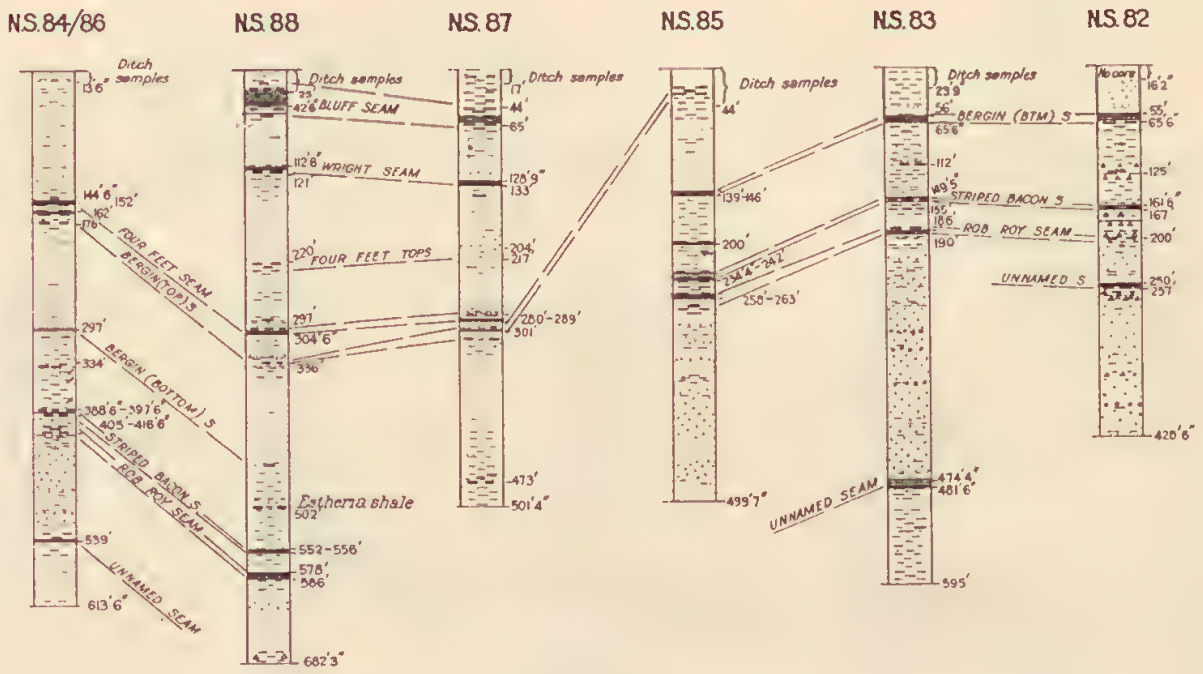


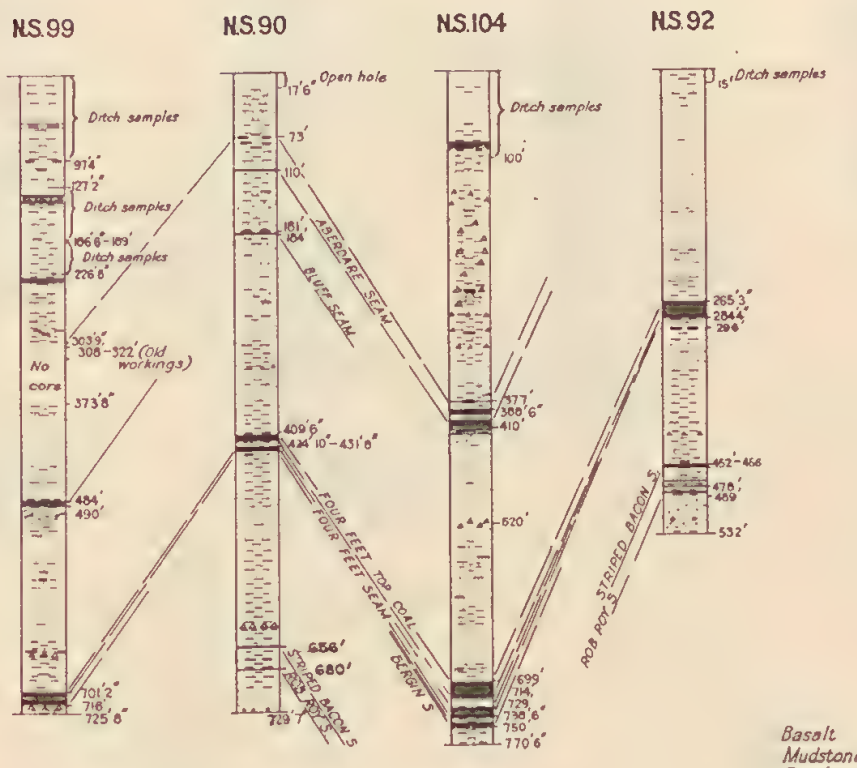
FIG.4

P.D.T.S. Nos. 9 AND 10 MINE AREAS

BLACKHEATH—BONNIE DUNDEE

GENERALISED BORE SECTIONS





LEGEND

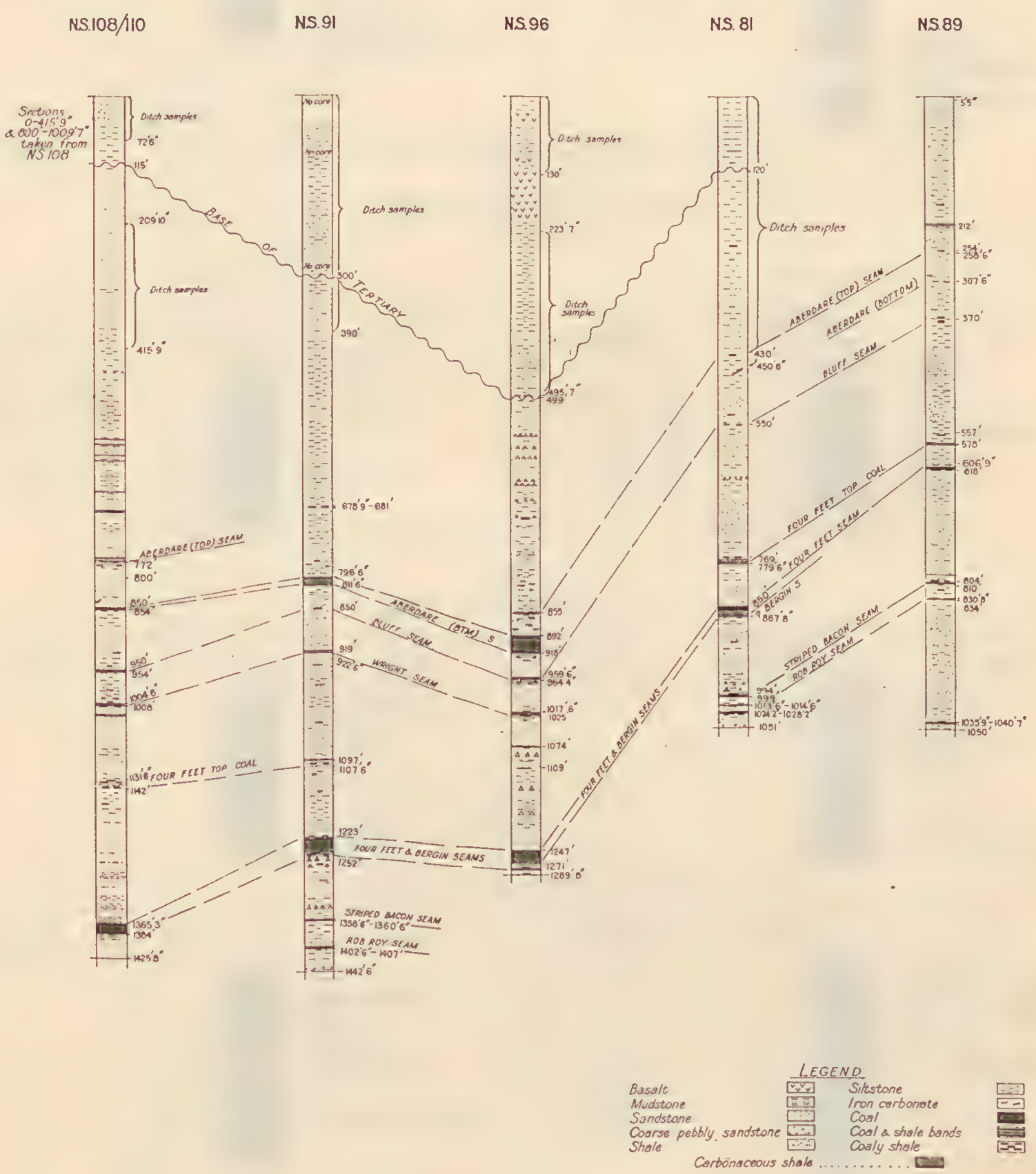
Basalt	Siltstone
Mudstone	Iron carbonate
Sandstone	Coal
Coarse pebbly sandstone	Coal & shale bands
Shale	Coaly shale
Carbonaceous shale	

FIG. 5

P.D.T.S. Nos. 9 AND 10 MINE AREAS

BLACKHEATH—BONNIE DUNDEE

GENERALISED BORE SECTIONS



JSD 15/3/57

FIG. 6

P.D.T.S. Nos. 9 AND 10 MINE AREAS

BLACKHEATH—BONNIE DUNDEE

DETAILS OF CORE RECOVERY AND ANALYSES

WRIGHT SEAM

N.S.87

Prox analysis, Washability etc.	Recovery percent	Sections sampled	Seam section	Description
A% 30.3 W ×	129'6¼"-133'2" Col 100	1/55		128'8¾" 3½"carb.sh with ½"coal at 2½"; 1¼"sheared med gy.sh; 2½"shaly coal, 2½"dk.gy.sh with coal lam & lents.; 129'6¼" ½"inf coal, ½"coal; 1"coaly sh.; 1½"bluey; 5"coal; ½"carb.sh; ½"bluey; ½"dk.gy.sh 2½"coal+bluey bottom; ½"brown siltstone; 10½"(partly broken) coal, 1"carb.sh., 1"coal, 3½"coal & inf coal lam.; 1½"coal; ½"carb.sh; ½"lt.gy.sh; ½"coal; 132'11½" 3½"coal with inf coal lam. 1"coal with fawn siltst. lents, 1"lt.gy.sh; ½"carb.sh; 1½"coal & inf coal with lam dk.gy.sh.

Overall recovery by col. 100 %

N.S.88

Prox analysis, Washability etc.	Recovery percent	Sections sampled	Seam section	Description
M% 1.9 VM% 24.2 FC% 41.3 A% 32.6 S% 0.27 Joules/gm. 21410 B.T.U/lb 9210 S.G. 1.594 W. ×	113'5½"-118'6½" Col 100	216/54		112'8" 2½"carb.sh; ½"inf.coal; 1½"m.g.sh with coal lents; 113'5½" 3"carb.sh.; 1½"med.gy.sh with carb.sh laminae; ½"inf.coal; 4"coal; 2½"carb.sh with coal lam & lents in btm 8"; 2½"(partly broken) coal; ½"carb.silt.st. with coal lents, 1½"fawn sh with coal lents, 2"(bkn) coal 75%, bluey 25%, 2'7½"(p.b in bottom 11") coal, 9"(p.b) coal, ½"fawn sh; ½"m.g.sh, 7"(p.b) coal. 118'6½" 2"(p.b) carb.sh with numerous coal lents & laminae. 9½"(p.b) med.gy.sh with coal lents, 1"carb.sh; 4½"(bkn) coal 80%, carb.sh 20%; 1"lt.gy.sh; 3½"(bkn) coal & med.gy.sh; ½"m.g.sh; 3"(p.b) carb.sh; 120'11½" 4½"(p.b) coaly sh.

Overall recovery by col. 100 %

N.B *Washability test (see Appendix 1), shown thus* .. W ×

SEAM SECTIONS FROM MINE WORKINGS

WRIGHT SEAM

BLACKHEATH No. 5 W.1

Prox analysis, Washability etc	Sections sampled	Seam section	Description
A% 29.2 SG 1.565 W × Prox anal on composite of floats M% 2.6 VM% 27.9 FC% 51.6 A% 18.5 S.% 0.29 Joules/gm 26710 BTU/lb 11490 S.G 1.456	510/55		6"coaly sh 2½"coal, 1½"dk.gy.sh, 2½"lt.gy.sh, 2'3"coal with 1"dk.gy.sh 1"lt.gy.sh; 1'2"coal, with bluey bands; 1½"lt.gy.sh; 10"coal

BLACKHEATH No. 7 W.2

Prox analysis, Washability etc.	Sections sampled	Seam section	Description
A% 37.8 SG 1.638 W × Prox anal on composite of floats M% 2.0 VM% 26.0 FC% 50.9 A% 21.1 S.% 0.29 Joules/gm 25870 BTU/lb 11129 S.G. 1.475	531/55		3"shaly coal, 5"lt.gy.sh, 4"coal; 1"wh.sh, 4"bluey, 1'7"coal with bluey bands & few sh.partings; 1"lt.gy.sh; 1'0"coal; ½"med.gy.sh, 7½"coal.

FOUR FEET SEAM

SUNRISE COLLIERY (BONNIE DUNDEE No. 2)

F.F.4

Prox analysis, Washability etc.	Sections sampled	Seam section	Description
Section only			4"coaly sh., ½"lt.gy.sh; 6"inf coal, few sh partings; 6"coal, 2"wh.sh, 2"coal; 1½"wh.sh; 6"coal, 4"bluey; 1'3"coal; 3"coal with carb lam; ½"dk.gy.sh; 1½"coal; 6"carb sh & bluey, 5"coal & carb sh lam; 2½"carb sh;

F.F.5

Prox analysis, Washability etc.	Sections sampled	Seam section	Description
Section only			5"coal, with sh lam; 1"lt.gy.sh, 11"coal with sh lam; 1½"inf coal; 2"lt.gy.sh; 1½"lt.gy.sh; 1"carb.sh; 1'10"coal; 8"bands coal & bluey; 1½"dk.gy.sh; 1'0"coal, few carb sh lam

E. S. CORNWALL COLLIERY (BONNIE DUNDEE No. 6)

F.F.6

Prox analysis, Washability etc.	Sections sampled	Seam section	Description
Section only			1"carb sh; 11"coal, 2"bluey, 1"lt.gy.sh, 1"bluey; 1½"lt.gy.sh; 1'0"coal; ½"lt.gy.sh; 6½"coal; 2½"lt.gy.sh; 1"coal; 1½"lt.gy.sh; 1 3'1"coal - usually with bluey band at btm.

F.F.7

Prox analysis, Washability etc.	Section sampled	Seam section	Description
M% 2.6 VM% 28.4 FC% 41.6 A% 27.4 S% 0.21 Joules/gm 22650 BTU/lb 9750 S.G. 1.492 Swell Index 2½			1"carb sh, 6"coal; 2½"fawn sh; 3½"coal; 1½"inf coal; 1½"lt.gy.sh, 8"coal; ½"lt.gy.sh, 11"coal, 2½"coal, 1½"lt.gy.sh, 1¼"lt.gy.sh, ½"carb sh, 3'8"coal.

P.D.T.S. Nos. 9 AND 10 MINE AREAS

FIG. 7

BLACKHEATH—BONNIE DUNDEE

DIAGRAMS OF MISCELLANEOUS SEAMS

DETAILS OF CORE ANALYSES

SEAM SECTIONS FROM MINE WORKINGS

FOUR FEET TOP COAL

BLACKHEATH No. 1 COLLIERY

F.F.T.C. 1

Prox. analysis, Washability etc.	Sections sampled	Seam section	Description
A% 38·7 SG 1·649 W × Prox. anal. on composite of floats M% 2·0 VM% 28·7 FC% 46·9 A% 22·4 S% 0·35 Joules/gm 25290 BTU/lb 10880 SG 1·46	138/55		3" bluey; 5" coal with thick carb sh laminae; 2" coal, ½" lt gy sh; 10" coal with bluey lam; ½" med gy sh; 2½" coal; 5" coaly sh; 1½" bluey; 6" coal; 1" med gy sh, 3" coal & thick bluey lam; ½" med gy sh; 6" coal, ½" lt gy sh, 3" coal, ½" dk gy sh; 3½" coal, 1½" lt gy sh; 2" coal; 2" lt gy sh; 2" coal, 1" med gy sh; 5" coal with bluey lam, ½" lt gy sh; 10" coal & bluey beds.

F.F.T.C. 2

Prox. analysis, Washability etc.	Sections sampled	Seam section	Description
A% 37·0 SG. 1·642 W. × Prox anal on composite of floats M% 2·3 VM% 28·7 FC% 47·1 A% 21·9 S% 0·34 Joules/gm 25420 BTU/lb 10940 SG 1·45	139/55		3" coal & sh; 1" med gy sh; 10" coal with sh partings; 2½" med gy sh; 1'3" coal with thin bluey beds; 8" bluey & coal lam; 2½" coal; 1½" lt gy sh; 2½" inf coal; 1½" lt gy sh; 1" coal; ½" dk gy sh; 1" inf coal; ½" lt gy sh; 5" coal & bluey, thick lam; 2" med gy sh; 1" bluey; 6½" coal; 1½" lt gy sh; 1½" bluey; 1½" lt gy sh; 9½" bluey & sh, thick lam; 4" bluey.

SUNRISE COLLIERY
F.F.T.C. 3

Prox. analysis, Washability etc	Sections sampled	Seam section	Description
Section only			6" coal with bluey lam; ½" med gy sh, 7" bluey & thick coal lam, 1" lt.-med gy sh; 7½" coal & bluey lam; 2" bluey → laterally med sh; 5" coal; 1" lt.-med gy sh; 3½" coal, 1" lt gy sh; 1½" coal; ½" dk gy sh; 11" inf. coal → coal; 1½" lt gy sh; 5½" coal, 1" med gy sh, 3½" coal; 3" lt & med gy sh with coal lam. 3" inf coal, 1" med gy sh; 3½" inf coal, 1½" sh; 1'1" bluey with thick coal lam; 6" sh & coal lam.

CORNWALL COLLIERY
F.F.T.C. 4

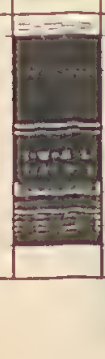
Prox. analysis, Washability etc	Sections sampled	Seam section	Description
A% 35·9 SG 1·62 W × Prox anal on composite of floats M% 1·9 VM% 29·8 FC% 47·9 A% 20·4 S% 0·29 Joules/gm 26370 BTU/lb 11350 SG 1·44 A% 38·0 SG% 1·65 W. × Prox anal on composite of floats M% 1·9 VM% 29·4 FC% 49·8 A% 18·9 S% 0·32 Joules/gm 26540 BTU/lb 11420 SG 1·44 A% 55·4 SG% 1·678	234/54 233/54		5" inf coal; 10" carb sh with coal lam; 8" carb sh & dk gy sh beds, 2½" bluey; 1" dk gy sh; 1'8" coal, few sh lam.; 4" dk gy sh; 1'0½" coal with bluey 8"-11"; 1½" dk gy sh; 7½" coal → bluey at 4"-7½"; 1" fawn sh; 2½" coal; 1" fawn sh; 10½" coal with bluey lam; 2" dk gy sh, 7" coal, 2" lt gy sh, 2" bluey with coal lam; 2" lt gy sh → med gy sh; 5" coal & bluey lam; 1½" lt gy sh; 4" coal; ¾" dk gy sh; 10" coal & bluey beds; 1½" lt gy sh; 4" coal; 2½" carb sh with lt gy sh; 1½" coal; 1" lt gy sh, 7" coal & bluey lam, 1" lt gy sh, 4" bluey with coal lam in top 1½"; 3" fawn sh, 1" coal; 1½" fawn sh, ½" bluey; ½" coal, ½" lt gy sh, 2" coal, 4" fawn → yellow leathery sh

N.B. *Washability test (see Appendix 1), shown thus . . . W ×*

BERGIN TOP SEAM

SUNRISE COLLIERY

B 1

Prox. analysis, Washability etc.	Sections sampled	Seam section	Description
Section only			3'6" med gy sh to F.F. Seam 10" coal; 2" bluey; 1'0" coal with sh partings, 1" dk gy sh; 1" coal; 1" lt gy sh; 1'1" coal → bluey in places; 3" carb sh; 1" lt. br. sh; 3" alternating coal & carb sh lam; 1½" br. → carb sh; 6" thin lam of coal, br sh & carb sh; 3" coal. floor shale.

B 2

Prox. analysis, Washability etc	Sections sampled	Seam section	Description
M% 2·3 VM% 26·2 FC% 33·3 A% 38·3 S% 0·21 Joules/gm 18790 BTU/lb 8060 SG 1·701 Swell Index 1			4' coal with few med gy sh partings, 1'5" coal with bluey lam; 2½" fawn sh with iron carb. grains; 1'6" coal & bluey beds; 3" coal; ½" lenticular dk gy sh; 1½" dk gy sh; 6½" coal; 1" lt gy sh; 3½" inf. coal. floor: 10" with sh & coal bands

P.D.T.S. Nos. 9 AND 10 MINE AREAS

BLACKHEATH—BONNIE DUNDEE

DIAGRAMS OF FOUR FEET SEAM

DETAILS OF CORE RECOVERY AND ANALYSES

FIG. 8

F.F. 1 (SEAM SECTIONS FROM MINE WORKINGS)

Prox analysis, Washability etc.	Sections sampled	Description
M % 2·0 V.M.% 28·2 F.C.% 49·1 A.% 26·6 S.% 0·22 Joules/gm 23750 BTU/lb 10220 SG 1·510		1'bluey, 1½"coal, 1"lt.gy sh; 2"coal; ½"lt gy sh; 1'4½"coal, 1½"wh sh, 1½"coal; 1½"wh sh, 2"carb sh with coal lam., 3'3"coal with thin bluey beds in top 1'3". 3"bluey.

F.F. 2 (BLACKHEATH No. 1 COLLIERY)

Prox analysis, Washability etc.	Sections sampled	Description
M % 2·2 V.M.% 27·6 F.C.% 43·1 A.% 28·8 S.% 0·22 Joules/gm 22660 BTU/lb 9750 SG 1·539		2"coal; ¾"sh; 1'3"coal with lam carb sh; 2"wh sh; 1"inf coal; 1¼"wh sh; ½"carb sh. 1'0"coal, ½"lt gy sh; 2'2½" coal; 2"alternate lam inf coal & lt gy sh

F.F. 3

Prox analysis, Washability etc.	Sections sampled	Description
M % 2·1 V.M.% 28·0 F.C.% 42·8 A.% 27·1 S.% 0·22 Joules/gm 23320 BTU/lb 10030 SG 1·514		2"coal → inf coal, 1½"dk gy sh; 2"coal; 5"carb sh with coal lam; 7"coal, 2"wh sh, 1¾"coal; 1½"wh sh, 1'10"coal with lam carb sh 7"inf coal; 1'1"alternate thin beds (up to 2"thick) of coal, bluey & carb sh

N.S. 86

Prox analysis, Washability etc	Recovery percent	Sections sampled	Description
A% 29·5 W × Prox anal on composite of floats M % 2·3 V.M.% 28·6 F.C.% 47·4 A.% 21·7 S.% 0·33 Joules/gm 25590 BTU/lb 11010 SG 1465 F.C.(Part)% 63·93	149'1½"-152'2½" Col 99·3	63/55	44'6" ½"fawn siltst, leathery band, ½"carb sh, 2½"(pb) inf coal with carb sh, 1½"coal, 5½"(pb) lt gy sh showing slickensiding; 6 med gy sh, ½"med gy siltst 3·3ft gy sh with coal lents; 2"carb sh with coal lents; ½"med gy siltst, 2½"dg sh with coal lents; ¾"inf coal; 1'7g sh; 1"coal with cal lacing; 2"carb sh & coal, 2"coal; 2"carb sh & coal; 4½"carb sh with coal lents; ½"inf coal; 1½"carb sh; 4½"(pb) coal with a little inf coal near top, 1'fawn sh, 4"carb sh, 4"fawn sh; 1½"b coal; 1'7g sh; 149'1½" 1"fissile coal (?fault); 3½"coal, splint type, possibly other inferior, 1½"coal; ½"lenticular carb sh; ½"coal, 1½"carb sh → bluey; 9"coal with carb sh partings thro'out & lacing of calcite, ½"carb sh with coal lam; 1"coal, ½"carb sh, 1½"coal with carb sh partings, ½"lenticle of bluey, ½"coal, 5"carb sh with coal lam top & bottom, ½"inf coal; ½"carb sh with coal lents & dg sh lens, 1½"coal with carb sh lam, 1"m g sh, 2½"(b) coal 80% & carb sh 20%; ½"dg sh; 1"inf coal; 1½"carb sh with coal lam. & lents & dk gy sh lens; 2½"coal. 152'1½"

N.S. 87

Prox analysis, Washability etc	Recovery percent	Sections sampled	Description
A% 33·2 SG 1·590	284'6½"-286'0½" Col 100		282' 1'fawn silt st (+leathery band) 7½"(part broken) coal; ½"med gy sh, 1½"inf coal, 1¾"carb sh, 4½"med gy sh, fractured & slickensided, ½"bluey, 1'1g sh; ½-1¼"irreg coal lens; 1"carb sh; 1'7g sh, 2"carb sh with coal lents, 2"coal, carb sh in places, 284'6½" 1'1g sh, 1¼"coal; 1"carb sh & m g sh with coal lam; 1"coal, ¾"inf coal, ¾"coal; 1"m g sh with coal lents; 1¼"coal laced with cale veins, 1½"bluey; ¾"coal laced 285'¼" with cale veins, 2"br sh; 4½"coal with carb sh lam, 286'0½" 4"carb sh, 1'1g sh, 4"inf coal, 1¼"coal; 1'1g sh; 1'5"coal with ½"inf coal bands at 2½" & 4"from bottom, 1"carb sh; 4½"coal ¼"med gy sh, ½"coal, ½"carb sh, 2½"coal, ½"carb sh, 9½"coal. 289'0½"
A% 8·12 SG 2·418	285'7½"-0½" & 2851'-286'0½" Col 100		
M % 1·9 V.M.% 28·7 F.C.% 42·7 A.% 26·7 S.% 0·42 Joules/gm 24060 BTU/lb 10360 SG 1·498 W. ×	286'0½"-289'0¼" Col 100	215/54	

N.S. 88

Prox analysis, Washability etc	Recovery percent	Sections sampled	Description
A% 27·4 S.G. 1·515	298'3"-300'2¾" Col 100		297'2¾" ½"carb sh → inf coal in btm 2"; 4"m g sh, ¾"coal, 1¾"m g sh with carb sh lam & lents; 1½"inf coal; 1¼"coal. 2½"g sh with coal lents & lenses, ¼"inf coal; ½"carb sh,
A% 7·7·5 S.G 2·323	299'9"-300'1¾" & 300'1¾"-2¾" Col 100		298'9"-½"coal with m g sh lam, 1½"m g sh; ¼"int coal, ¼"coal, ¼"m g sh; 1"coal; 3½"m & g sh with coal lam; ¼"coal ¼"carb sh with coal lents, 9½"coal, ¾"carb sh with coal lents,
A% 4·18 S.G 1·678	300'2¾"-302'2¾" Col 100		300'2¾"-½"1'g sh; 2½"coal, ¼"fawn sh, 1½"lt gy sh; 1"coal, 1"bluey with lt gy sh parting at top, 1"coal, 1"bluey → carb sh with lt gy sh parting at btm, 3"carb sh, ½"dg sh, ½"carb sh, 1"coal, ½"bluey, 2"coal, 2"carb sh, 1"coal & sh, ½"bluey, 4"coal with carb sh lam, 1"irreg bedded m g sh & carb sh, 6½"coal with carb sh lam, 302'2½" ½"coal, ½"inf coal, 1¼"carb sh with coal lents, ¼"coal, 1"(bkn) carb sh 75%, m g sh 6½", coal 10%; 10'4"med gy sh with bands of carb sh & numerous lents of coal thro'out; 5"coal, 1½"carb sh with num coal lents & lam, 304'4½" 2½"(bkn) m g sh with coal laminae, ¾"m g sh; ½"carb sh; 2¼"coal with carb sh lam.

N.S. 89

Prox analysis Washability etc	Recovery percent	Sections sampled	Description
A% 61·3 M % 2·0 V.M.% 29·0 F.C.% 48·3 A.% 20·7 S.% 0·28 Joules/gm 26110 BTU/lb 11230 SG 1·460 W ×	611'4½"-613'4½" Col 100 Excluded A% 68·0 SG% 2·092 Col 100 Excluded 613'2½"-613'3½" 611'0½"-616'0¼" Col 100	220/54	606'9½" ½"inf coal, 1½"fawn sh; ½"inf coal, ½"dk gy sh with coal lents; ½"coal, 3½"carb sh with m g sh parting at bottom; 3½"coal → inf coal btm ½"; 1"m g sh; -2½"bluey & inf coal, 6"(pb) coal with carb sh lam, 2"carb sh with fawn sh parting 5"from top, ¼"inf coal; 1½"(pb) med gy sh; 2½"lg fawn sh; 1'fawn sh, 1"irreg coal lens; 2"fawn sh, 1"coal & inf coal; ½"med gy sh; ½"coal; ½"carb sh, 1¾"fawn sh → silts in part, 1½"fawn leathery sh; -4½"bluey → inf coal in bottom 1"& in bands thru out, 5½"coal with 1g sh lens 3½"from top; 611'4½" 1"int coal, ½"coal, 3"carb sh with coal bands btm 1", ¼"med gy sh; ½"coal, 2"boulder, 1½"coal; ½"boulder, 8"coa., 1"inter bedded med gy sh, coal & carb sh, 1"coal, ½"int coal, 612'10½" 2"m g sh, ½"carb sh, a"inf coal, 1½"inf coal, 1"coal, 613'3½" 1"carb sh, 1'1g sh, 1"carb sh with coal band at top; 5½"coal, some inf; 1½"irreg carb sh with coal band at top; 1'4½"(pb) coal, ½"irreg lens carb sh, 3"coal, 1½"inf coal, 9½"coal, ¾"inf coal, 616'6½" ½"dg sh with carb sh lam; 1½"inf coal; 1½"carb sh; ½"coal, 1½"carb sh with coal lents; 1½"dg sh; ½"coal; 1'1"m g sh; ½"br silt st; 5"bk sh with carb sh lam; 2"carb sh; 618'1½" 4"coal with ½"carb sh band 1½"from top.

N.S. 90

Prox analysis Washability etc.	Recovery percent	Sections sampled	Description
W × M % 2·3 V.M.% 29·6 F.C.% 43·8 A.% 24·8 S.% 0·22 Joules/gm 24610 BTU/lb 10590 SG 1·481	425'-425'3½" Col 100	223/54	424'10¾" 1½"fawn sh with btm ½"leathery band, 1"carb sh, 2½"coal with m g sh parting at btm, 425' 10"(part broken) coal; 425'1½" 4½"(pb) carb sh; ½"lt gy sh; 426'4½" ½"carb sh → inf coal, 5"coal, ½"med gy sh, 6"coal, 4"f-m gy sh, ½"bluey, 5"coal, 3½"coal with bands of carb sh, a lenses of dk gy sh, and sh, 427'10½"-428'0½" 1'1"gy sh, 1½"inf coal, 428'2"-428'3½" 1½"lt gy sh, ½"carb sh; 1'7¼"coal; 1'9"(pb) coal, 431'8½" 5"carb sh with coal lents, 1½"m g sh with carb sh & coal 1½"from top, 1'1"m gy sh, 3"m & f-m gy sh lenses; 432'6" ½"carb sh, ½"coal, ½"carb sh with coal lents, ½"inf coal, ½"carb sh with coal lents, 1"(pb) coal
A% 7·3·0 SG 2·219	425'11½"-426'4½" & 427'10½"-428'0½" & 428'2"-428'3½" Col 100		
M % 1·7 V.M.% 31·2 F.C.% 49·7 A.% 17·4 S.% 0·24 Joules/gm. 27330 B.T.U/lb. 11760 SG 1·426 W ×	428'3½"-431'8½" Col 100	225/54	

N.S. 104

Prox analysis. Washability etc	Recovery percent	Sections sampled	Description
A% 32·8 W. × Prox anal on composited floats M % 2·1 V.M. % 30·7 F.C. % 49·2 A % 18·0 S % 0·26 Joules/gm. 26600 BTU/lb 11450 SG 1·450 F.C.(Part)% 62·76	730'11½"-734'4¾" Col 100	66/55	730'8½" 3"fawn sh with puggy clay band in btm 1", 730'11½" 3"carb sh with numerous coal lam (almost inf c.) 1¾"coal, ½"carb sh; 3½"coal → carb sh 1", 1'7g sh, 3"coal → inf coal ½", 2"carb sh with coal lenses in btm ½" a num coal lam: & lents thru out; ½"carb sh, ½"dg sh, 1½"bluey → carb sh, ½"m g sh with ½"carb sh band ½"from top & → 1g sh at btm, 6"coal with few sh partings & layers of irr carb nodules 3"from top, ½"m g sh, ½"inf coal with cale lacing; 1¼"carb sh, 1'7g sh, 9½"coal with few carb sh lam thru out, 734'4¾" 2½"coal with 1g sh partings top & bottom, ½"carb sh, 2'7g sh, with few streaks carb sh in top 6½", 734'11" 1¼"carb sh with ½"inf coal in middle; 1½"1g sh, 1¼"carb sh, 3'6"coal with few sh partings in btm 10½"; 738'5" 2½"carb sh, 2'6"sh; 1¼"carb sh, 8½"carb sh with some bk sh bands & with numerous coal lam & lents thru-out, 1"inf coal with cal lacing, 740'2" 5¼"carb sh with few coal lents.
A% 14·1 S.% 0·23 Joules/gm. 28080 BTU/lb 12080 SG 1·398	734'11"-738'5" Col. 100		

N.B. *Washability test (see appendix 1), shown thus.....W.* ×

FIG.9

P.D.T.S. Nos. 9 AND 10 MINE AREAS

BLACKHEATH—BONNIE DUNDEE

DIAGRAMS OF MISCELLANEOUS SEAMS

DETAILS OF CORE RECOVERY AND ANALYSES

N.S.90 — FOUR FEET TOP COAL — N.S.104

Prox analysis Washability etc	Recovery percent	Sections sampled	Seam section	Description
A% 35·4 W × Prox anal or composite of floats M% 3·2 VM% 10·7 FC% 48·2 A% 18·9 S% 0·25 Joules/gm 26310 BTU/lb 11320 SG 1450 FC (Parm)% 62·32	413'4½"-418'1½" Col 100	6⅝/55		½"(part broken) carb sh; ¾"(part bkn) inf coal, 1½"coal, ½dk gy sh., ½"carb sh with numerous coal lam & lents; 3"dk gy sh., 1½"carb sh.; ½"coal; ½"inf coal, 6½"carb sh with coal bands in top ¾"dk gy sh bands in btm 2", 2¾"bands of coal & carb sh with lam of dk gy sh [illegible] ¾"dk gy sh with coal lents; ½"coal, [illegible] dk gy sh with coal & carb sh lam.; [illegible] ½"carb sh with coal lam., 2½"coal with dk gy sh lam.; 1½"dk gy sh with coal bds, ½"inclu & carb sh lam.; 3¾"dk gy sh., 1¾"(part bkn) dk gy sh; ½"carb sh, 1½"coal with thin lam carb sh.; ½"inf coal, 2"dk gy sh with irreg carb sh lents in top 1", 1"carb sh with coal lents in top ½"; 1½"dk gy sh., 1¾"carb sh.; ½"bk sh., ½"inf coal; 1½"dk gy sh., ½"carb sh; ½"bk sh; ½"bluey; ½"dk gy sh with coal lents; 10½"coal, 1½"carb sh → bluey., 3½"(part bkn.) coal, ½"inf coal; ½"med gy sh with [illegible] 7"coal with large 2"irreg lens dk gy sh → carb sh in btm., 1½"(broken) coal with thin lam carb sh., [illegible] carb sh with coal lents & with med gy sh lent in [illegible], ½"inf coal; ½"med gy sh., 1"carb sh., ½"dk gy sh., 1½"bluey with coal lam.; 2"inf coal, 2½"bk sh., 2½"coal with bands inf coal, ½"carb sh; ½"inf coal, ½"carb sh., ½"inf coal, 4"irreg dk gy sh lam., ½"coal; ½"carb sh; 2½"coal with dk gy sh & few inf coal lam., 5"carb sh with numerous coal lents., ½"inf coal, 4"carb sh, 3"coal with dk gy sh parting 1"from top, 1"gy sh, carb part, 3½"(part broken) coal; ½"med → fawn sh., ½"carb sh with coal lam., 2½"fawn sh., 1½"med gy sh., ½"carb sh with coal lam., 1½"coal with fawn sh lens in top 1", 2 bands of carb sh thru-out & with thin silts lam 3" from top, 1½"(fawn) coal with pyritic carb sh band, ½"; ½"med → fawn sh., ½"inf coal, 1½"brown., 1"carb sh with coal lam.; 5½"bluey, 2½"dk gy sh., ½"carb sh, 1½"dk gy sh., 1"carb sh, 1½"(pb) inf coal, ½"fawn sh, ½"carb sh, 3½"dk gy sh., 1½"(pb) inf coal, 3"carb sh with med gy sh lens in top 1", ½"coal, 1"med → fawn sh, 7"carb sh & coal lam., iron carb in btm 1", 2½"coal, 1"med gy sh; 2½"inf coal → carb sh, ½"coal, 1½"buff sh., med gy at top, 2"coal → carb sh & coal, 1½"lt gy sh, 1½"carb sh; ½"lt.-med gy sh, ½"inf coal; ½"carb sh; 1½"lt.-fawn sh	40'6" 43'2" 428'10½"
A% 40·2 W × Prox analysis (composite of floats) M% 2·0 VM% 29·4 FC% 44·5 A% 24·3 S% 0·26 Joules/gm 24730 BTU/lb 10640 SG 1482 FC (Parm)% 61·80	702'4½"-706'8½" Col 100	6⅝/55		½"carb sh with dk gy sh & few coal lents, 2"dk gy sh., 11½"carb sh with regular ¼" bands inf coal throughout, & with with 1"dk gy sh 2½"from top; 3½"dk gy sh & thin carb sh bands with coal lam. & lents within, 2"inf coal with irreg lenses & bands is dk gy sh from ½"-1½" from top; 2½"med grey sh., 4"coal, 2½"dk gy sh, 1½"interbedded inf coal & med gy sh bands, 4"carb sh; 1"inf coal & carb sh bands, 6"dk gy sh with few coal lents, 2½"slightly carb sh with 1"coal & [illegible] with lam & thin bands coal, 5"[illegible] gy sh, [illegible] coal, ½"carb sh with coal lens, 1"coal, ½"carb sh., 5"(part broken) coal with thin carb sh bands ¼" & ½" from top, 5"(part broken, some of this core may be out of place) dk gy sh with ½"coal ½"from top; 5"(part broken) coal, ¾"carb sh, 4"coal with several dk gy sh partings; 9½"inf coal, with bands carb sh throughout; 2½"carb sh., 2"inf coal; ½"coal, ⅜"inf coal; 4½"black slightly carb sh., 3"inf coal with ½"black sh 1½"from top 4"carb sh with coal lam. throughout & three ½"coal bands at ½", 1½" & 3½" from top; 3¾"inf coal with ½"lens bk sh 1"from top; ½"coal, 3"bk sh with carb sh lam., ½"carb sh., 1"inf coal, 1"dk gy sh with carb sh bands with coal lents in [illegible] inf coal, ½"dk [illegible] sh, 1½"bk sh with coal sh bands, 1½"inf coal & coal, 2½"carb sh with few coal lents, 2½"dk gy sh; ½"carb sh; ½"coal, 5½"carb sh with coal lam. in top ½" & in bottom 2½" which is almost → inf coal; ½"bk sh., 6"carb sh, ½"coal; 2½"irreg interbd carb sh & dk gy sh; 2½"carb sh with numerous coal lam. & lents.; 1"(part bkn) irreg lens shaly coal, 3"dk gy sh; ½"coal, 2"slightly carb dk gy sh with coal lam; 1½"coal; 1½"carb sh with numerous coal lam & lents., ½"(part broken) coal, ½"dk gy sh with carb sh lents, 1"inf coal; 1½"carb sh with coal lam with ½"coal at bm, 1½"dk gy sh, ½"carb sh, 6½"(part broken) coal with ½"carb sh at 2½"from top; 2½"lt.-med gy sh; ½"carb sh with coal lam.; 3"lt gy sh with lenses med gy sh, 2½"carb sh with lenses med gy sh; ½"bluey with fawn sh parting at top; 1½"coal with calcite lacing top ½"; 3½"med gy sh with carb sh. & fawn sh bands 1½"from top; ½"carb sh with coal lents top ½"; 3"inf coal with coal bands top 1", 4½"interbedded med., lt gy & carb sh bands with few coal lam; 1"carb sh → bluey; 3"inf coal → coal in places; 4"carb sh with ½"inf coal at 1½" & at 3½"from top, 5½"coal; 1½"carb sh with few coal lenses	699'9½" 702'4½" 706'8½" 714'0½"
Overall recovery by col 100%				
Overall recovery by col 98·9%				

N B *Washability test (see appendix 1), shown thus* ...W ×

DIAGRAMS OF MISCELLANEOUS SEAMS

DETAILS OF CORE RECOVERY AND ANALYSES

N.S.92 — TOP COAL & FOUR FEET SEAM — N.S.81 — FOUR FEET & BERGIN SEAMS

Prox analysis, Washability etc	Recovery percent	Sections sampled	Seam section	Description
M% 1·6 VM% 30·0 FC% 44·2 A% 24·2 S% 0·24 Joules/gm 24690 BTU/lb 10590 SG 1·49 W × A% 76·3 / FC 2266 A% 61·2 / SG 1·978 M% 1·8 VM% 26·2 FC% 33·8 A% 33·8 S% 0·19 Joules/gm 19030 BTU/lb 8190 SG 1·660 W × A% 77·9 SG 2·319 M% 1·3 VM% 27·5 FC% 38·0 A% 33·6 S% 0·19 Joules/gm 20650 BTU/lb 8890 SG 1·608 W. × M% 2·1 VM% 32·4 FC% 49·4 A% 16·1 S% 0·28 Joules/gm 25070 BTU/lb 12070 SG 1·404	267'1½"-270'10½" Col 100 269'4½"-269'9½" Col 100 269'4½"-270'10½" Col 1·978 269'10½"-275'3" Col 97·7 275'3"-276'0½" Col 97·4 276'0½"-279'9" Col 100 279'9"-284'3" Col 100	3⅛/sh 2226/54 231/54 229/54		1"(brown) carb sh & dk gy sh, 1"(bkn) inf coal, ½"coal with carb sh lam., ½"irreg lens carb sh., ½"coal, 1½"carb sh with coal lam., 1½"inf coal & bluey, 1"coal, ½"dk gy sh., 1"carb sh., ½"irreg band dk gy sh., 10"coal (part bkn in btm 5") with ½"carb sh bands 5" & 5½" from top, 1½"(bkn) coal with bluey bands; ½"dk gy sh → carb sh 1", 2"(bkn) coal with some bluey bands; ½"dk gy sh., ½"(bkn) coal; 1"coal; ½"bluey; ½"coal, ½"carb sh., ½"bluey, 3"part bkn) coal 50% carb sh., ½"coal; 3½"carb sh with numerous coal lenses, 1½"(pb) coal, ½"dk gy → carb sh., 2½"carb sh with bluey & coal bands; ½"coal → inf c., 1½"m-d gy sh., ½"carb sh with coal lam; 1½"lt.-m gy sh with carb lam; ½"carb sh with coal lam., 1"coal, ½"carb sh with coal lam., 3½"coal, ½"lt.g sh; 1½"coal with carb sh lam; ½"coal, ½"coal with carb sh lam, 1½"bluey, 1½"coal; ½"m-dg sh with coal lam; 5½"(part bkn) coal, ½"bluey, 1"m-dg sh, 2"(pb) coal, 1"m-dg sh, 1½"coal with sh partings, 1½"g-dg sh, ½"carb sh with coal lam, 1"coal, 1½"lg sh with coal lam lenses in top ½", 1½"fawn sh; 3½"(pb) coal with carb sh lam, ½"br.silt st.; 1½"(pb) coal, ½"(pb) lg sh; ½"dg sh with med & fawn sh partings at btm, ½"coal with carb sh at btm; 10"(part broken) coal with bands up to 1"wide inf c & 1"carb sh 2"from btm, 1"m g sh, 1"carb sh with coal lam; 1½"coal, 1½"carb sh → bluey; ½"coal, ½"carb sh.; ½"carb sh with lg sh parting at top & btm, ½"carb sh, 1½"(pb) coal; ½"(pb) inf c, 1"lg sh, ½"(bkn) coal y sh; ½"(pb) coal, ½"slightly carb sh; 3"(pb) coal with iron carb partings & lenses; 1½"coal with carb sh lam, 4½"lg sh with coal lents in top 1", 1"(pb) coal y sh, 4½"yellow sh with ½"feathery parting at base, 1"bluey, 1½"coal, ½"inf coal, 4½"coal → inf coal ½", ½"carb sh., 1"lt gy-creamy sh; ½"coal, 2"(pb) coal, 3½"carb sh; ½"med gy sh; ½"carb sh, 1"inf coal, ½"lt gy sh; 7½"coal (partly inf) with iron carb nodules thru-out & two sh partings, 1"-m gy sh; ½"carb sh; 4½"coal, 1"(bkn) bluey, 1"inf coal, 1"(part bkn) coal; ½"bluey; 5½"coal with sh partings; ½"lt.gy sh, 2½"coal with sh partings & with ½"carb sh at top, 1"lt gy sh, 1"carb sh with few coal lents; 3½"coal with ½"dk gy sh band ½"from btm., 23"coal with fawn sh partings at 10½" & 11½" from top, 1"carb sh, ½"inf coal → coal; ½"inf coal, 1'6½"broken) coal with ½"sh band near or at btm & ½"band inf coal 4"from top; 1"brown sh with coal lents thru-out; ½"coal.	265'3" 266'7" 269'4½" 269'10½" 275'3" 276'0½" 279'9" 284'3" 284'6½"
Overall recovery by col 100%				
Overall recovery by col. 100%				

Prox analysis Washability etc	Recovery percent	Sections sampled	Seam section	Description
M% 2·1 VM% 29·5 FC% 44·6 A% 23·8 S% 0·27 Joules/gm 24660 BTU/lb 10610 SG 1·484	843'4½"-858'6½" Col 100			7½"(part broken) coal with little carb sh (<5%); 2"fawn sh., 5½"(bkn) coal, ½"med gy sh showing slickensides, 6½"coal; ½"(pb) med gy sh; 10"(bkn) coal, penny band, 1½"(pb) coal; 2½"coal; 1½"med gy sh; 2"(finely bkn) 85% coal, 15% lt gy sh; 4'3½" coal, 2½"coal with cal lacing, 1"med gy sh (lenticular ½" / ¼"), 5½"coal, inf coal & carb sh; ½"carb sh; ½"coal; 1½"med gy sh/st with coal lents, 2½"carb sh with coal lents, 3½"(bkn) coal 70%, carb sh 30%; 2"(pb) m g sh, slickensid, 2½"(bkn) m g sh, fract. & slickided, 2½"m g sh with few coal lents & showing fractures dipping at 55°-65°, 7½"med gy sh/st., fracturing top 4"; 9"carb sh with numerous coal lents & lenses; 3"m g sh with coal lents; 2"coal with sh partings; 2"med gy sh with coal lents; 5½"med gy sh/st with coal lents; ½"inf coal with sh partings, 3½"dk gy sh, 2½"carb sh with coal lents in top ½", 6"(bkn) carb sh & sooty coal (? result ?), 3½"med gy sh with coal lents., 1½"coal with calcite lacing, 4½"med gy sh with coal lents, 1"carb sh with coal lents, ½"coal with cal lacing, 1½"carb sh with coal lents; 4½"coal with cal lacing, 1½"(bkn) dk gy sh 70%, coal 30%; ½"inf coal, ½"m g sh, 1"inf coal, 2½"coal, 1½"carb sh, ½"coal, 1½"m g silt st with coal lents, 2"coal & inf c., 1"lg sh, 1½"carb sh with coal lents; 4½"(bkn) inf coal (50%) & carb sh, 1½"m g sh with coal lents, 2"coal, 1"carb sh with coal lents, 1"coal with cal lacing, 1½"inf coal with numerous carb sh partings, ½"(bkn) carb sh & coal lents, 2½"carb sh with numerous coal lents, 2½"dk gy sh., 7"(broken) inf coal 30%, coal 20%, carb sh 50%	849'1½" 858'6½" 867'6"
Overall recovery by col. 100%				

P.D.T.S. Nos 9 AND 10 MINE AREAS

FIG. 10

BLACKHEATH—BONNIE DUNDEE

DIAGRAMS OF FOUR FEET AND BERGIN SEAMS

DETAILS OF CORE RECOVERY AND ANALYSES

N.S. 91

Prox analysis Washability etc	Recovery percent	Sections sampled
A% 32·0 SG 1·601	Col. 78·9	1229'6"-1230'10½"
A% 65·3 SG 2·075	Col. 100	1230'10½"-1231'4½"
M% 1·7 VM% 32·9 FC% 50·6 A% 15·4 S% 0·28 Joules/gm 28440 BTU/lb 12110 S.G. 1·406	Col. 100	1231'4½"-1234'6½"
A% 50·3 SG 1·838	Col. 100	1234'6½"-1236'3"
M% 1·8 VM% 30·9 FC% 48·3 A% 19·6 S% 0·27 Joules/gm 26290 BTU/lb 11310 SG 1·484	Col. 100	1236'3"-1239'10¼"
A% 41·0 SG 1·707	Col. 100	1239'10¼"-1246'2"

Overall recovery by col. 94·9 %

1225'4½" 2¼"carb.sh with coal lam.;
1¾"coal with ¼"carb.sh with coal lents. in middle; 1'8"g.sh,
2½"(p.b) coal & inf coal with carb.sh. lam.,
6"lt.gy.sh. with ¼"carb.sh. 4½" from top,→fawn sh.; ½"bluey,
½"coal, ½"fawn sh., ½"coal, 1¾"fawn sh. with carb. lents,
3½"fawn plastic clay band,
2½"(bkn) coal 60% & carb.sh. with coal lents., 2"carb.sh. with c.lents.

8"(p.b) carb.sh. & med.gy.sh.,

8½"(bkn) coal & inf coal 90%, carb.sh. & d.g.sh. 10%.

1230'8" ½"carb.sh. with coal lents.; 1'd.g.sh.(fractured);
7½"(bkn) shaly coal with few thin bands of boulder
& fawn sh.→bluey in bottom 1½".
1¼"coal, ½"interbedded coal & carb.sh.,

1230'10½" 3"(bkn) coal 70%, carb.sh. 30%;

1231'1½" 2½"fawn sh. with ½"bluey ½"from btm.; 1"coal & carb.sh. lam.;

1231'4½" ½"fawn sh. with coal lents.(irreg. up to ½inde); 1"carb.sh.
1"(bkn) carb.sh. with coal lents.;
1'7"(p.b) coal & inf coal with fine carb.sh. partings
throughout & ½"carb.sh. 4"from btm.;

1'7½"(p.b) coal & inf coal;

1234'6½" 2½"(bkn) carb.sh. with coal lents. 50%, d.g.sh. 30% & c. & inf c. 20%;
½"d.g.sh., 1½"bluey, 5½"(p.b) coal→inf.coal,
½"bluey; 1½"(bkn) carb.sh. with coal lents. 90% & d.g.sh.;
4½"d.g.sh. with ½"carb.sh. 1½"from top, ½"carb.sh. & coal lam.;

1236'3" 2½"(p.b) carb.sh. with coal lents. & lenses,

1'9"(p.b) coal & inf coal with few carb.sh. partings,

½"carb.sh. with coal lents,

1'6½"(p.b) coal & inf coal.

1239'10¼" 2"d.g.sh.; 1½"(part broken) coal;
9½"(bkn) coal & inf coal 80%, m.g.sh. 20%;

1'4½"(bkn) coal & inf coal 60% & carb.sh.

9½"(bkn) coal & inf coal with ½"d.g.sh. 2"from btm.
1"bluey; 1½"(p.b) coal,
5½"m.g.sh. with few thin bands carb.sh. with coal lents
& lenses; a little coal;
7½"(bkn) coal & inf coal,
½"carb.sh. with coal lents; ½"boulder,
4"(bkn) coal & inf coal; ½"bluey;
6½"(bkn) coal & inf coal, 1'0"g.sh. with coal lents.;
6½"(p.b) coal & inf coal, at least two ½"band carb.sh.;

1246'2"
7½"carb.sh
¾"coal; 1"carb.sh.; ½"inf.coal;
3"d.g.sh., with carb.sh lam.;

1247'6½" 1½"coal & inf coal, 1½"carb.sh. with coal laminae.

N.S. 96

Prox analysis, Washability etc	Recovery percent	Sections sampled
A% 32·5 SG% 1·570 W ※		
Prox. anal on composite of floats M% 2·5 VM% 30·1 FC% 50·1 A% 17·5 S% 0·29 Joules/gm 27100 BTU/lb 11660 SG 1·426 FC.(Parn) 63·66	Col. 99·1	1250'2"-1252'1" 549/54
A% 80·9 M% 1·9 VM% 31·3 FC% 53·8	Col. 80	1252'7"-1253'
A% 13·0 S% 0·27 Joules/gm 26810 BTU/lb 12400 SG 1·393	Col. 97·1	1253'-1256'7½"
M% 1·9 VM% 29·7 FC% 51·6 A% 16·8 S% 0·25 Joules/gm 26730 BTU/lb 11500 SG 1·447	A% 69·8 Col. 67·6; A% 60·0 Col. 100	1256'7½"-1257'3¾"; 1257'3¾"-1258'0¾"; 1258'0¾"-1258'6"
A% 21·5 SG 1·477 W ※	Col. 99·3	1258'8½"-1261'7" 555/54
Prox. anal on composite of floats M% 2·2 VM% 31·0 FC% 52·8 A% 14·0 S% 0·23 Joules/gm 28550 BTU/lb 12300 SG 1·397 FC.(Parn) % 64·79		

Overall recovery by col. 97·1%

1247'1" 1"(p.b) coal; 1"carb.sh with coal lents; ½"m.g.sh; ½"inf.coal→,
1"carb.sh with coal lents.; 3'1g.sh;
¾"coal, 1¼"g.sh,
3"(p.b) coal; 1'1g.sh; ½"leathery fawn sh.; 1"bluey;
¾"coal; ½"carb.sh.;
7½"coal
½"g.sh.; 1½"carb.sh with coal bands, 2"m.g.sh with few coal lents
1"carb.sh with numerous coal lam in top ½"; 1½"d.g.sh;
5½"irreg interbedded carb.sh. & some dk.gy.sh.;

1250'2" 2¾"coal, ½"inf.coal with lg.sh parting at top, ½"carb.sh.;
1¾"coal with bluey lam.; 1'0"g.sh. with carb.sh. lam.
2½"coal, 1"fawn sh.;
16½"coal with ½"d.g.sh. 5"from top, ½"lent carb.sh. lens 8"from
top, fawn sh. lents from 9½-11½"from top & with 2½"
somewhat inf.coal 10½"-13"from top,

1252'7" 1¾"lt.gy.sh with few coal lents.; ½"carb.sh,

1253' ½"(p.b) carb.sh., 1¾"lt.gy.sh.,
½"carb.sh.; 8"coal;
1"irreg lens med. & dk.gy.sh.;

18½"coal with penny band between 1"& 2"from bottom;

½"carb.sh with med.gy.sh parting at bottom;
¾"carb.sh., irreg. band;
1¾"coal with few carb.sh. laminae in top 6";

1256'7½" ¾"(p.b) 1"m.g.sh with few coal lenses in top 1",
1"carb.sh with coal lents. & calcite lacing, ½"(irreg→½")
fawn sh., ½"carb.sh with coal lam.; 4"coal; ½"carb.sh→inf.c.

1257'3¾" 3¾"coal;

1258'0¾" 6"m.g.sh with coal bands from 3"-3¾" & 4½"-5½" from top;

1258'6" ½"shaly coal;
1"coal, 1½"bluey; 1"inf.coal; 2"coal, 2"inf.coal;
3"coal; 1"carb.sh with coal lents.; ½"coal; ½"carb.sh. with
lents. m.g.sh.; ½"coal, 1½"carb.sh & inf.coal bands;
3½"coal; 1"irreg lens carb.sh.; 1½"coal with ½"lens f.-m.g.sh
in btm., 1"carb.sh with coal lents & lenses;
1½"coal; ½"f.-m.g.sh.;
10½"coal with calcite lacing for 3"-4½" from top & ½"carb.sh
2½"-5" from top;

1261'7" 2¼"(p.b) f.-m.g.sh.; 3¾"inf.coal, ½"(p.b) med.gy.sh.,
1"(p.b) coal; ½"d.g.sh., ½"bluey→coal; 3"f.-m.g.sh.;
4½"interbedded ½"bands carb.sh., bluey & coal; 1¼"m.g.sh.;
¾"carb.sh. with lenses m.g.sh. & few coal lents.; 1½"coal & carb.sh.
lam.; 1½"carb.sh. with thin coal bands & m.g.sh. parting at top;
¾"f.-m.g.sh., 1¾"coal; ½"carb.sh.; 6½"coal with few ¼"carb.sh.
bands & lam. throughout, ½"(p.b) coal; 1"m.g.sh.;
1"coal; 5"carb.sh. with coal bands in bottom 2";
1"inf.coal, ½"f.-m.g.sh., 1"(p.b) coal; ½"carb.sh.; 1¾"m.g.sh.
with few coal lents., ½"carb.sh., ½"d.g.sh.,
5"coal; 1½"dk.gy.→carb.sh. with coal lents.;
3½"coal with dk.gy.sh. & carb.sh. lam.; 1½"d.g.sh.→carb.sh.
m.part; 1"coaly sh., 1"m.g.sh. with few coal lents.; 1"coaly sh.,
1"m.g.sh., 1½"coaly sh.; 1"m.g.sh.; ½"inf.coal, 1½"d.g.sh.,
2½"bluey→inf.coal from ½"-2"from top; ½"m.g.sh.;
2"coal; ½"m.g.sh., 2½"coal with carb.sh. lam throughout,
1"m.g.sh. with coal lents.; 2"inf.coal; 1½"inf.coal,
1½"carb.sh., 2"m.g.sh. with coal lam.; 2½"carb.sh. with coal bands
up to ½"inde;
2½"coal, 2½"carb.sh. with numerous coal bands→inf.coal;
1½"d.g.sh., 1"carb.sh. with coal lam. & lents.
2½"d.g.→lg.sh.; 1"bluey; 1½"inf.coal with carb.sh. laminae;
1"m.g.sh. with carb.sh. lents.; ½"inf.coal, 1"carb.sh. with coal lam
& lents.; 4½"d.g.sh., ½"irreg. lens carb.sh.; 1"irreg. band d.g.sh.;
1½"coal→inf.coal, 1"carb.sh. with lam. & lents. of coal;
2'0"6" 2"coal with calcite lacing.

N.B. *Washability test (see appendix 1), shown thus* W ※

N.S. 99

Prox analysis, Washability etc	Recovery percent	Sections sampled
M% 2·0 VM% 27·6 FC% 43·8 A% 26·6 S% 0·24 Joules/gm 23120 BTU/lb 9970 S.G. 1·56	Col. 97·3	703 1½"-706'9"

Overall recovery by col. 73·8%

701'10¾" ½"coaly sh.; 1½"m.g.sh., ½"(bkn) carb.sh. & coal, ½"(p.b) bluey;
4½"(p.b) carb.sh., 1"(bkn) coal;
4½"(p.b) coal 60%, m.g.& carb.sh. 40% (2 x 1" bands coal & few c. lam.)
1½"coal; 1½"m.g.sh; ½"g.sh., 1½"coal with carb.sh. & fawn sh.
parting between ½"& 1"from top; 2½"f.-m.g.sh. with fawn sh.

703'7½" lam→brsh. at bottom (bkn);
¾"carb.sh. with coal lents., ½"coal; 2½"(bkn) carb.sh. & coal (with
fragments fawn sh. which have come from marker bands, comixed→);
6½"(p.b) coal; 2"coal with med.gy.sh. parting at top;
½"carb.sh. with f.-m.gy.sh. lents.; 6½"(p.b) inf.coal (coal bands & carb.
sh. bands alternating); 6½"(p.b from 4"-5½" from top) coal;
1"carb.sh. with coal lents.;
2½"coal; 5½"(p.b) med.gy.sh. with coal lents. & lam. with 1"carb.sh.
with coal lam. & lents. at bottom,

706'9" ¼"coal; ½"inf.coal (1½"partly broken),

No recovery, coal & sh. bands; faulting in this section,

707'9"

Nine to seven

11"(b.core), 5"(p.b) boulder, bel. coal & inf.coal & carb.sh.,

1½"(p.b) coal with ½"carb.sh. band; ½"coal; ½"m.g.sh.,
1½"coal; 1"med.gy.sh.;
8"(p.b) coal with ¾" & ½" band d.g.sh. at 1"& 2½" unprox
respectively;
1½"bluey, 1½"(p.b.) m.g.sh. fragments with carb.sh. bands
½"inde at top & bottom; 1"(p.b) ½"coal, ½"carb.sh.; ½"inf.coal,
3"carb.sh. with coal lam & th.n bands from 1"-3"from top &
with fawn sh. lents. in top 1"& d.g.sh. lens at 1½"from top;
½"irreg. lens m.g.sh. with iron carb. granules, ½"coal; 2½"(p.b.)
716' ½"carb.sh; ½"irreg. band m.g.sh., 4½"(p.b) coaly shale;

N.S. 110

Prox analysis, Washability etc	Recovery percent	Sections sampled
A% 79·3	{1368'10"-11½" 1369'0½"-1½" White band's excl'd} Col. 100	
A% 19·7 W ※	Col. 100	1368'11½"-1372'½" 67/55
Prox. anal on composite of floats M% 1·9 VM% 28·3 FC% 51·0 A% 16·8 S% 0·19 Joules/gm 27770 BTU/lb 11950 SG 1·422 FC.(Parn) % 63·84		
M% 1·9 VM% 27·3 FC% 41·5 A% 29·3 S% 0·17 Joules/gm 22580 BTU/lb 9720 SG 1·564	Col. 100	1373'6½"-1378'1½"
A% 29·9 W ※		
Prox. anal on composite of floats M% 1·9 VM% 29·1 FC% 50·1 A% 18·9 S% 0·29 Joules/gm 23·30 BTU/lb 10·30 SG 1·441 FC.(Parn) % 64·57	Col. 100	1378'1½"-1383'11" 68/55

Overall recovery by col. 100 %

1365'5½" 4"carb.sh (almost coal of sorts), 1"irreg band d.g.sh.,
¾"coal; ¾"d.g.sh. with coal & carb.sh. laminae;
11½"m.g.sh with coal lam. from 7"-10"from top,
¾"f.g.sh.;
2¾"d.g.sh. with carb.sh. lam. & lenses, few coal lam;
½"carb.sh.; ¾"coal; ½"d.g.sh., 1¼"inf.coal, ½"d.g.sh.; 1½"carb.sh.;
2½"d.g.sh with numerous coal lam; 5½"carb.sh with coal lam→

1368'1⅛" inf.coal bem 2",
6½"coal with carb.sh lam in top 3", 2"carb.sh→inf.coal in mid 1",

1368'10"-11¼" 1½"f.-m.g.sh.,
1369'0½"-1½" 1½"m.g.sh.; ½"carb.sh. & coal irreg bands, ½"coal,
½"carb.sh., 1"coal→inf.coal; ½"bluey, 3"(p.b) coal,
4"inf.coal; 1½"carb.sh. with numerous coal laminae;
4½"coal;
3¾"coal with carb.sh. bands up to ½"wide throughout,
2½"coal slightly inf.; ½"carb.sh.,
2"inf.coal→coal in parts; ½"d.g.sh., carb. at ends; ¾"coal,
6"(bkn) carb.sh. & inf.coal (coal lam throughout),

1372'½" 3½"(bkn) coal 70%, carb.sh. 30%;
2"carb.sh. with numerous coal lam→coal btm 1",
½"(p.b) m.g.sh. with coal lam; ½"lt.brsh., 1"carb.sh.,
3"very inf.coal, 2"coal,
1"carb.sh., 2½"d.g.sh., 1½"irreg. interbedded carb.sh. & c. lenses,

1373'6½" 12½"coal with carb.sh. parting at 4", lt.-med.gy.sh. partings
at 4½", 5½" & 8½" & with bands inf.coal bet. 4" & 10" from top;
bands ½"-1" wide, (broken core bottom 3½");
2'2"coal with ¾"m.g.sh. (p.b.c.) at 7½" from top, ½"m.g.sh. at 10½"
& 1"boulder at 1'3" from top;

1'8½"m.g.sh., 3½"inf.coal; 2½"carb.sh. with m.g.sh. lenses at top &
bottom, ½" wide, almost inf.coal from ½"-1½" from top;
2½"coal; 2"bluey, grading down to carb.sh. in places;

1376'1½" 2½"coal, slightly inferior;
5"bluey & inf.coal, ½"dk.gy.sh. with coal lam.,
2½"coal, 2"inf.coal,
10"(p.b) coal, lt.gy.sh. parting at 6"from top;
3½"carb.sh. with coal lam. & band in top 1½";
1"coal, ½"carb.sh.; ½"bluey;
4"carb.sh. with coal lam.→bluey;
11½"(p.b) coal,

3½"carb.sh. with numerous coal lam.→inf.coal in places;
1"carb.sh., 3½"very inf.coal,
1¾"inf.coal with d.g.sh. parting at the top; ½"carb.sh.,
½"m-d.g.sh.; ½"carb.sh., ½"coal; ½"carb.sh.;
11½"(bkn top ½") coal;
1"f.-med.gy.sh.;
6½"coal;

1383'11" 2'd.g.sh.; ½"carb.sh.; 1"(broken) coal.
1384'2½"

FIG. 11

100 E
120 E
140 E
160 E
180 E
200 E
80 N
60 N
40 N
20 N
00
20 S

N.S.160/1957
R.L. surf. 232·05
R.L. btm. -39·63

N.S.150
R.L. surf. 214·25
R.L. btm. -56·36

N.S.163/1957
R.L. surf. 191·88
R.L. btm. -401·48

N.S.92/1954
R.L. surf. 138·80
R.L. F.F. -140

N.S.89/1954
R.L. surf. 189·44
R.L. F.F. -425

NOBLEVALE

FAULT

REDBANK PLAINS ROAD

Blackheath No.1 D.D.
(approx. posn.)

N.S.82/1954
R.L. surf. 140·28

E.S. CORNWALL
(Late Bonnie Dundee No.6)

POSSIBLE LINE OF FAULTING

N.S.104/1954
R.L. surf. 201·78
R.L. F.F. -535

N.S.90/1954
R.L. surf. 150·36
R.L. F.F. -280

R.L. surf. 197·02
N.S.83/1954
Outcrop Four Feet Seam
(A) Archibald & Hunter Tunnel
(A) Reid & Archibald Tunnel
SUNRISE
(Late Bonnie Dundee No.2)

NOBLEVALE No.4 A

N.S.81/1954
R.L. surf. 199·07
R.L. F.F. -660

FERNIE Ck A

FAULT

BLACKHEATH No.1

N.S.96/1954
R.L. surf. 127·39
R.L. F.F. -1126

N.S.85/1954
R.L. surf. 159·67

LITTLE JIM A

BLACKHEATH No.5

BLACKHEATH

N.S.91/1954
R.L. surf. 134·58
R.L. F.F. -1103

BLACKHEATH No.2 A

N.S.87/1954
R.L. surf.
R.L. F.F. 54

BLACKHEATH No.6
R.L. F.F. 208

BLACKHEATH No.7

Outcrop F.F.

N.S.99/1954
R.L. surf. 199·03
R.L. F.F. -509

N.S.84/1954
N.S.86/1954
R.L. surf. 253
R.L. F.F. 103
Blackheath No.2 D.D.
(approx. posn.)

N.S.88/1954
R.L. surf. 271·41
R.L. F.F. -30

BLACKHEATH No.4 A

N.S.110/1955
R.L. surf. 202·21
R.L. F.F. -1167

N.S.108/1954

BONNIE DUNDEE No.1
No.5 TUNNEL A

P.D.T.S. Nos. 9 & 10 Mine Areas
BLACKHEATH - BONNIE DUNDEE
SKELETON PLAN
SHOWING
STRUCTURE CONTOURS
FOUR FEET SEAM

To accompany report by B.W. Hawkins B.Sc., Geologist.

SCALE OF CHAINS
10 8 6 4 2 0 10

N.B. Contours drawn on base of seam at 50' intervals
All levels referred to State Datum

LEGEND
Fault
Colliery BLACKHEATH
Structure contour —100—
Diamond drillhole

J.S.D. 20·9·56

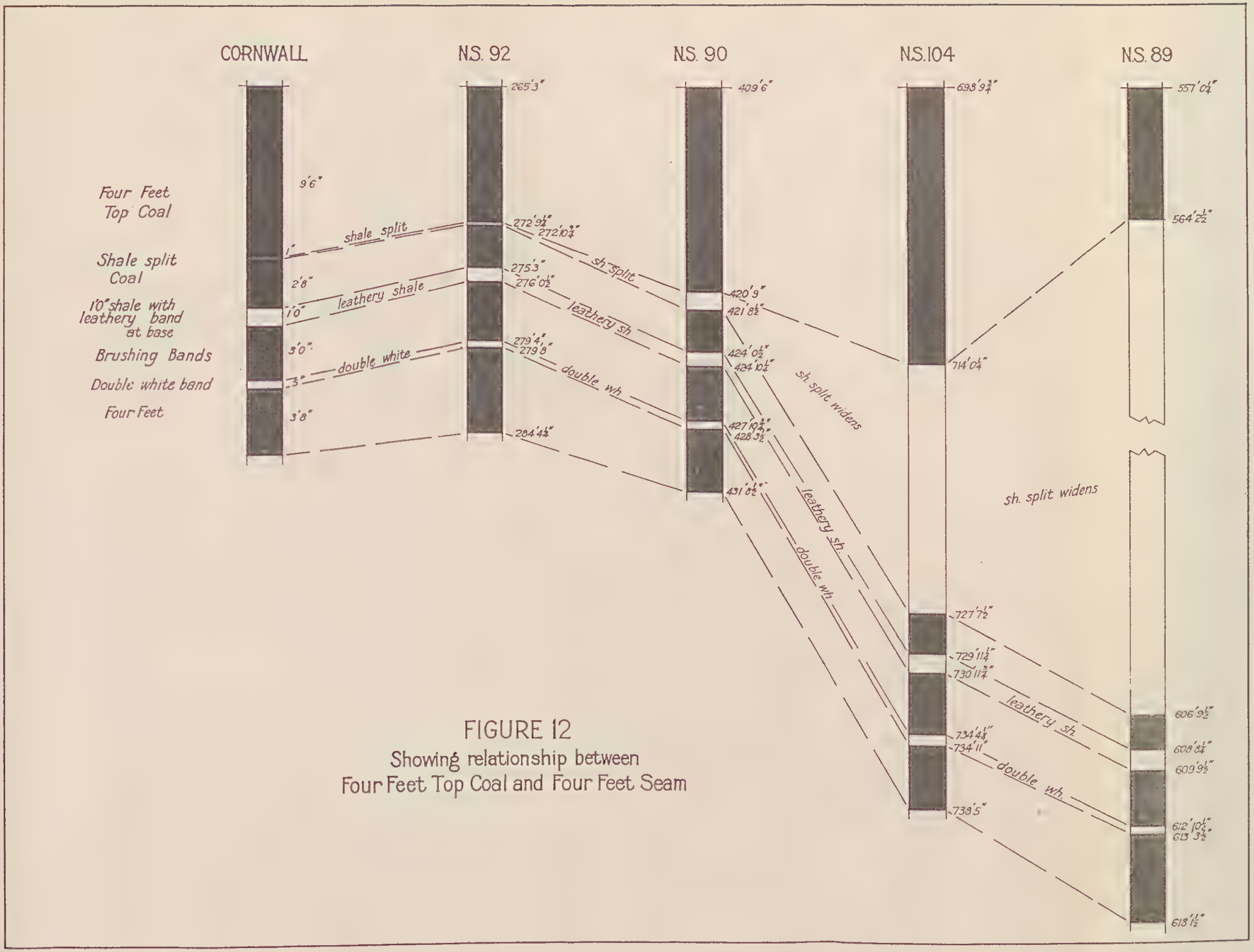


FIGURE 12

Showing relationship between
Four Feet Top Coal and Four Feet Seam

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 289

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 9. SOUTHERN CROSS No. 9 MINE AREA

By H. R. E. STAINES, B.Sc., Geologist.

PART 10. P.D.T.S. No. 4 MINE AREA, NEW HOPE

By B. W. HAWKINS, B.Sc., Geologist.

BRISBANE
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SUMMARY.

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Diamond drilling was carried out during the period January to June 1955 to define the limit of reserves in the Lagoon Seam extending south-easterly from those previously established in P.D.T.S. No. 3 Mine Area (Swanbank Lagoon) and to provide information necessary for mine development at Southern Cross No. 9 Colliery.

Two machines together drilled five holes, ranging in depth from 580 ft. 10 in. to 1,204 ft. 11 in. and aggregating 4,596 ft. 4 in. Core recovery was highly satisfactory, amounting to 95·9 per cent. overall and 98·2 per cent. in coal seams.

This report, accompanied by eight figures and one table, sets out the results of drilling and geological examination.

The greater part of the area, which lies on the south-western limb of the Bundamba anticline, is relatively free from faulting but along the eastern boundary the strata are severely disturbed. Variations in lithology and stratigraphy throughout the area are described in some detail as the basis for correlations between sub-surface sections and surface exposures.

Five seams were tested in the Blackstone "Stage" of the Ipswich Coal Measures, here some 600 ft. thick. The Aberdare Seam, split into unworkable sections in the northern part of the area, has been removed in the southern part by erosion. The Bluff and Wright Seams show wide variation in both thickness and quality and limited reserves of workable coal have been defined only in the latter. The Lagoon Seam is economically the most attractive and contains substantial reserves. The (?) Rob Roy Seam is nowhere workable.

In rank, the coal is high-volatile bituminous with average fixed carbon content (D.M.M.F.) of 64·9 per cent.

Measured reserves in the Wright Seam, calculated over an area of 55 acres with average workable thickness of 4 ft. 3 in., amount to 450,000 tons with average weighted ash content of 24 per cent.

In the Lagoon Seam, reserves have been calculated over an area of 141·9 acres lying to the south-west of Southern Cross No. 9 Colliery. Based on seam sections which show an overall average ash content of less than 30 per cent., reserves amount to 3,120,000 tons. Average ash content is 27·2 per cent., and average workable thickness is 11 ft. 4¼ in.

Washability tests indicate that, with rejection of 21 per cent. at sp. gr. 1·8, ash content of this coal would be reduced to 17·7 per cent. Washing at higher specific gravity could therefore be practised to yield a product still of marketable quality.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

22nd May, 1957.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.
PART 9. SOUTHERN CROSS No. 9 MINE AREA.

1. Introduction.

Southern Cross No. 9 Colliery, currently producing at the rate of approximately 120 tons a day from the Lagoon Seam, is located in portion 95, parish Bundamba, on C.M.L. 358.

Drilling by the Mines Department in the Swanbank Lagoon area during 1950 and 1951 established the existence of substantial reserves in the Lagoon Seam within Nos. 1, 2, and 3 Mine Areas designed by Powell Duffryn Technical Services Ltd. In the area south-east of P.D.T.S. No. 3 Mine Area, both the subsequent opening of Southern Cross No. 9 Colliery on this seam and the continued deterioration of the Bluff Seam in Southern Cross No. 8 Colliery established the need for defining the limit of reserves in this direction. Diamond drilling was therefore extended to this area in 1955 and a geological examination was carried out.

This report sets out the results of the campaign and the deductions therefrom, and is illustrated by the following plans and sections:—

Fig. 1.—Plan showing topography, surface geology and drillholes. Locality plan.
Fig. 2.—Plan showing mine workings, drillholes and limits of estimated reserves.
Fig. 3.—Cross sections.
Fig. 4.—Generalised drillhole sections.
Fig. 5.—Detailed sections of Bluff Seam.
Fig. 6.—Detailed sections of Wright Seam.
Fig. 7.—Detailed sections of Lagoon Seam.
Fig. 8.—Skeleton plan showing structure contours of Lagoon Seam.

2. Diamond Drilling.

The diamond drilling campaign was begun on 24th January, 1955, using the Mines Department Sullivan 200A rig. The Department's Joy Sullivan 37 rig was also later moved to the area. Drilling was completed on 7th June, 1955. The two machines together drilled five holes numbered respectively N.S. 112, 113, 114, 116, and 117. The holes ranged in depth from 580 ft. 10 in. to 1,204 ft. 11 in., the total footage being 4,596 ft. 4 in.

Core recovery was generally highly satisfactory. The total length cored was 4,507 ft. 0 in. and the core recovered amounted to 4,320 ft. 5¼ in., representing a recovery of 95·9 per cent. In the coal seams this overall figure was improved upon, a total of 406 ft. 2¼ in. of core being obtained from 413 ft. 4½ in. This represents 98·2 per cent. recovery.

3. Geological Succession.

The north-eastern half of the area under consideration is occupied by the coal-bearing Blackstone "Stage" of the Ipswich Coal Measures, while the south-western half is occupied by massive beds of the Bundamba Sandstone. A narrow strip of Aberdare Conglomerate separates these two geological units and lies unconformably on the coal measures.

Post-Triassic sedimentation has been of limited extent. A section of the Triassic coal measures in the north-east is obscured by a comparatively thin blanket of (?) Tertiary sediments. The watercourses are flanked by alluvium of variable extent.

(*a*) Ipswich Coal Measures.

The oldest strata outcropping in this area belong to the Blackstone "Stage". The coal seams penetrated by the drillholes are in descending order as follows:—

Aberdare (Bottom section)
Bluff
Wright
Lagoon
(?) Rob Roy

If the correlation of the lowest seam with the Rob Roy Seam be correct, then the Blackstone "Stage"—defined as the sequence from the pavement of the Rob Roy Seam to the base of the Aberdare Conglomerate (Denmead, 1955A)—has here a maximum thickness of 600 ft. The upper 400 ft., comprising the beds above the base of the Lagoon Seam, are represented on the surface within the area. A notable feature of the upper half of this sedimentary sequence is the lenticular nature of the strata, which is illustrated on section A–A′ in Figure 3.

The Aberdare Seam is the highest seam in this sequence. It diminishes in thickness to the south, and finally disappears altogether near the boundary between portions 96 and 97. The top section peters out in the north-west of portion 95 mainly through having been eroded prior to the deposition of the Aberdare Conglomerate. Towards the crop this erosion level reaches and removes the horizon of the bottom section also. In fact, in the entrance to New Hope No. 2 Tunnel in portion 98, the conglomerate is seen to rest upon and partly replace the underlying Bluff Seam.

In the drillholes there is a maximum of 170 ft. of strata between the Aberdare Seam "bottoms" and the Aberdare Conglomerate. This section is predominantly sandstone with interbedded shale and siltstone. The interval from the Aberdare "bottoms" to the Bluff Seam is variable, ranging from 50 ft. in N.S. 114 to 170 ft. in N.S. 117. In the other three holes it is slightly over 100 ft. Towards the outcrop, the shales of this section partially give way in the upper half to sandstone.

The average thickness of the Bluff Seam in the five holes is 26 ft. 3½ in. Below it is a lenticular bed of siltstone and shale up to 40 ft. thick. The Wright Seam underlies this and has a thickness of nearly 10 ft.

The Lagoon Seam lies about 100 ft. below the Wright. The intervening strata are interbedded thick beds of sandstone and shale. The full section of the Lagoon Seam averages 16 ft. 10 in. in thickness.

The next stratigraphic interval, that between the Lagoon and (?) Rob Roy Seams, is occupied by from 110 ft. to 160 ft. of shale and siltstone. Within this section the small bivalved crustacean *Estheria* occurs, being preserved in a bed of black shale lying from 20 ft. to 60 ft. below the Lagoon Seam. Fossils were found in only two of the drillholes, but the characteristic shale persists throughout the area drilled. *Estheria* was previously found between the Bergin and Striped Bacon Seams in the drill core from P.D.T.S. Nos. 7 and 8 Mine Areas at Bundamba (Denmead, 1955B), but there is no record of its occurrence in the intervening Swanbank Lagoon area.

A dolerite sill has been intruded into the sediments of the lower half of this section. Its thickness varies considerably but is mostly around 6 ft. In some places it has been intruded into the (?) Rob Roy Seam with resultant destruction of the adjacent coal plies. In N.S. 114 three doleritic intrusions were penetrated, the largest having a 25 ft. intersection, halfway between the Lagoon and (?) Rob Roy Seams. From examination of the drill core it was apparent that this intrusive body was a dyke which had been injected along a fault plane.

On the surface a dolerite sill outcrops near Southern Cross No. 9 Colliery nearly 3 chains ahead of the tunnel entrance. Although it lies some 40 ft. above the Lagoon Seam at the outcrop it intersects the seam on the southern (upthrown) side of a 14 ft. fault at a point 12 chains down the tunnel. This is probably the same sill as that occurring above the (?) Rob Roy Seam in the drillholes. Another outcrop of what is probably again the same sill occurs in a gully in the north-eastern corner of portion 95.

The highly banded 40 ft. to 50 ft. seam referred to as the "(?) Rob Roy" Seam is underlain in those holes which completely penetrated it by a bed of sandstone which is considered to belong to the Cooneana "Stage".

(*b*) Aberdare Conglomerate.

Outcrops of Aberdare Conglomerate in the area are only a few feet in thickness. In the drillholes the maximum development is in N.S. 113 where it occurs as two beds 13 ft. 6 in. and 29 ft. thick respectively, separated by an interval of 24 ft. This interval is occupied by sandstone and a pinkish-coloured shale impregnated with iron carbonate in the form of acicular crystals. The surface occurrences are typical of the Aberdare Conglomerate as developed elsewhere on the field. One exception is the outcrop forming a dip slope on a hill in the north-east corner of por. 97. The coarse conglomerate phase is here poorly represented and the main rock type is a medium- to coarse-grained pebbly sandstone; nevertheless its siliceous character is still evident. This exposure is one of several disconnected outcrops in the east of the area which are all considered to be stratigraphically equivalent to the Aberdare Conglomerate. The scattered distribution of these outcrops results from faulting which is discussed later in this report.

The pinkish ferruginous shale referred to is commonly associated with the conglomerate and outcrops as a band of limonitic concretions and ironstained shale.

(*c*) Bundamba Sandstone.

The sandstones of this sequence form conspicuous outcrops in the south-western part of the area. Interbedded with them are siltstones and some shales, particularly in the lower 400 ft. of the section intercepted in the drillholes. The greatest thickness measured was 530 ft. in N.S. 113, the westernmost of the drillholes. Lying between 50 ft. and 80 ft. above the base of the Bundamba Sandstone is a shale sequence about 10 ft. in thickness containing a few thin bands of coal.

(*d*) (?) Tertiary Sediments.

In the east of portion 95 a deposit of pebbly soil covers an area of some 15 acres and can be seen in a steep-sided gully to overlie a loosely consolidated conglomerate with a reddish clay matrix. In each case the component pebbles are identical with those constituting the Aberdare Conglomerate, of which there are several outcrops in the immediate neighbourhood. The conglomerate in the gully has apparently been formed by the reconsolidation of debris from eroded portions of the Aberdare Conglomerate. The age of this deposit cannot be designated with any certainty other than as post-Triassic. Probably it is late Tertiary.

(*e*) Alluvium.

Oaky Creek flows in a general north-westerly direction across the area and is flanked by minor deposits of alluvium which have been omitted from the geological map.

4. Structural Geology.

(*a*) Bundamba Anticline.

The strata in this area form part of the south-western limb of this major structure. The general strike is NNW.–SSE. and the dip is west-south-west at angles slightly steeper than 20 deg. There is a general flattening to the south-west to about 12 deg. Angles of dip as low as 7 deg. and 2 deg. in sections of the deeper holes may be attributed to the modifying influence of folding movements on original irregularities in deposition.

The axis of the anticline passes through the extreme north-eastern corner of portion 95.

(*b*) Faulting.

A number of faults have been mapped in the eastern part of the area. Additional faulting must be inferred to provide a satisfactory explanation of the relative positions of a number of outcrops of Aberdare Conglomerate here. Because of the comparative

paucity of exposures it is difficult to draw a complete picture of the obviously complicated fault pattern. Where no other positive information is available the faults shown on Figure 1 have been deduced from the disposition of the conglomerate outcrops.

The principal exposure of Aberdare Conglomerate terminates abruptly in the southern part of portion 97, in an area dissected by several faults. At a position 34 chains north of this—alternatively described as 10 chains east-south-east of Southern Cross No. 9 tunnel—there is an outcrop of conglomerate which has been thrown from the first position across a nearly meridional fault. The displacement due to this fault has apparently been exaggerated by strike faulting, since a third isolated outcrop occurs in the north-east of portion 97 about half-way between the first two exposures. A fourth outcrop of conglomerate about 6 chains long and striking approximately NW.–SE. lies midway along the boundary between portions 95 and 153. It is probably continuous under the (?) Tertiary sediments with the second-named outcrop nearest to the colliery entrance, except for a certain amount of displacement across a fault concealed beneath those sediments.

Yet another conglomerate outcrop lies on the eastern boundary of portion 97 and runs south-east into portion 98. It has evidently been thrown into this position by a NE.–SW. fault which is probably continuous or nearly so with one which has been observed in portion 37.

The dolerite sill outcropping near Southern Cross No. 9 tunnel is apparently cut off to the south-east by a fault which intersects the outcrop of the Lagoon Seam near the mouth of the tunnel. This fault may extend northwards to link up with one of the faults met with in the United No. 5 workings.

Several other faults are shown on Figure 1, but are of minor importance only. Faults encountered underground in Southern Cross Nos. 8 and 9 Collieries, while inconveniencing mining operations, are not of major importance.

This eastern section is but part of a zone of faulting displaying a general NNW.–SSE. trend. It occupies a strip some 8 chains wide on the north-east of United No. 5 Colliery in portion 94 and widens as it stretches across portions 101 and 95 to portions 153, 98 and 97. The result is a roughly wedge-shaped area of disturbance extending for about a mile across the southern end of the Bundamba Anticline.

5. Coal Seams.

(*a*) Aberdare Seam.

The Aberdare Seam, split into Top and Bottom sections, is not workable in the area. The greatest thickness measured in the drillholes was 2 ft. 7¼ in. in the Bottom section in N.S. 117.* It is considered that towards the south both parts have been eroded prior to deposition of the Aberdare Conglomerate. A. K. Denmead (1955A) correlated the seams in two prospecting tunnels in portion 97 with the Top and Bottom sections of the Aberdare Seam respectively. The present writer however considers them to be the same seam and, moreover, part of the Bluff Seam, dislocated here by minor faulting. The evidence leading to this conclusion is discussed in the following section describing the Bluff Seam.

(*b*) Bluff Seam.

The Bluff Seam, penertated in each of the holes drilled in the area, shows considerable variation both in thickness and in quality. A persistent feature is a band of light-coloured indurated shale and siltstone lying towards the upper part of the full seam section. Though it varies in thickness from 13 inches to 10 feet its colour and lithogical characters are regarded as being sufficiently distinctive to provide a reliable basis for correlation withn the area.

The greatest seam thickness is 35 ft. 3½ in. in N.S. 117. In N.S. 114 and N.S. 116 the Top section, lying above the "white" marker band described above, disappears, and in N.S. 116 the remainder of the seam splits into two sections corresponding roughly to the Middle and Bottom sections of the Bluff Seam. These consist mainly of carbonaceous shale and coal bands and are 6 ft. 0 in. and 8 ft. 9½ in. thick respectively, separated by nearly 21 ft. of shale. The marker band lies on top of the upper split.

A tunnel in portion 97 six chains east of N.S. 116, known as Wright's Tunnel, is considered for two reasons to be on the upper split of the Bluff Seam in this locality. In the first place, the projection of the upper part of the seam in N.S. 116 towards the surface is very nearly coincident with the downward projection of the seam in the tunnel each being drawn at its measured angle of dip (25 deg. and 22 deg. respectively); and in the second place, the hard creamy-coloured shale prominent in the partially collapsed roof strata is to all appearance the same as the marker band in N.S. 116.

Since the same shale appears in the strata overlying a collapsed tunnel four chains due north of Wright's Tunnel, this opening is also considered to lie on the upper split—corresponding to the Middle section—of the Bluff Seam.

After correlating these two occurrences on lithogical grounds, it is then necessary to explain their failure to lie on the same line of strike. This may be attributed to an east-west fault in the intervening area, postulated on the evidence of a dislocation in the nearby conglomerate and a zone of disturbance in a siltstone and shale outcrop adjacent to the second tunnel.

On the left bank of Oaky Creek near the western boundary of portion 98 there is a four feet thick seam of poor quality coal exposed in a tunnel referred to as Sparkes' Tunnel. Since there occurs in the roof shales of this tunnel a hard creamy-coloured band

*Unless otherwise stated, seam thicknesses quoted are true stratigraphic thicknesses, allowance having been made for the dip of the strata as measured in the drill core.

indistinguishable from the abovementioned band, the seam is regarded as the same section of the Bluff Seam as that in Wright's Tunnel.

A somewhat similar band of indurated shale occurs overlying a four feet coaly section in a tunnel 14 chains to the north, and it is suggested that this also might be correlative with the Wright's Tunnel seam.

In N.S. 112 the Middle and Bottom sections are virtually non-existent. All that remains of the seam is an 11 ft. 6 in. section four feet above the marker band.

A thickness of 4 ft. 2 in. containing 28·8 per cent. ash is the only part approaching workability. Another section of workable quality exists just below the "white" band in N.S. 113 (4 ft. 6½ in., containing 25·5 per cent. ash) and N.S. 114 (4 ft. 2¼ in. containing 29·3 per cent. ash).

The Bluff Seam was worked in Southern Cross No. 8 Colliery over an area of approximately 13 acres but because of continued deterioration extraction ceased about September, 1955.

(*c*) Wright Seam.

The Wright Seam also shows some variation in thickness, although not to the same degree as the Bluff Seam. Except for a few thin bands of coal at about 725 ft. it is virtually absent from the stratigraphic section in N.S. 112. This anomaly is noteworthy in view of the disappearance of the lower part of the Bluff Seam in the same hole. At this stage of deposition of the coal measures there was evidently a marked decrease in the quantity of vegetable matter being deposited in this locality. This may have been due either to the existence here of a locally elevated portion of the lake floor, or merely to the failure of swifter-flowing currents to deposit their load in this vicinity.

In the other four holes the thickness of the seam ranges from 9 ft. 6 in. to 14 ft. 9 in. The best section lies at the top of the seam in each case. In the three holes where its ash content is not greater than 30 per cent. this section averages 4 ft. 3 in. and 24 per cent. ash.

A. M. McKenzie (1952B) measured a 7 ft. 9 in. thickness in the Wright Seam in a shaft 2½ chains south-east of Southern Cross No. 8 tunnel and sampled the top section in two places. One sample covering 5 ft. 10 in. contained 34·2 per cent. ash (2½ in. shale excluded) and the other, in two parts covering 5 ft. 0 in., contained an average of 30·6 per cent. ash.

(*d*) Lagoon Seam.

The Lagoon Seam is economically the most attractive in the area. The full seam section averages 16 ft. 10 in. varying from 14 ft. 6 in. in N.S. 112 to 19 ft. 5 in. in N.S. 117. The workable section lies at the top of the seam, usually immediately below the roof shales. It ranges in thickness from 8 ft. 6¾ in. in N.S. 112 to 12 ft. 10½ in. in N.S. 113 and averages 11 ft. 5¾ in. The average ash content of the drillhole sections sampled is 27·8 per cent.

An arbitrary division of the workable section into three parts can be made on the basis of the shale bands and the seam has been sampled accordingly. The middle section, averaging 5 ft. 7¼ in. and 25·5 per cent. ash, is of better quality than the remainder. The "tops" are about 3 ft. 4 in. thick and contain 29·2 per cent. ash. A sample of the working section taken by the Queensland Coal Board at a point 160 yards from the mouth of Southern Cross No. 9 tunnel over a 10 ft. 8¼ in. section contained 25·0 per cent. ash.

In a shaft 5½ chains east-north-east of Southern Cross No. 8 Tunnel, A. M. McKenzie (1952A) measured a vertical section of 11 ft. 8 in. in the Lagoon Seam. A sample taken over 6 ft. 1½ in. in the lower part of the seam contained 24·8 per cent. ash.

It is likely that part of the Lagoon Seam will be of unworkable quality owing to the intrusion of the sill described previously. Since this sill overlies the seam at the mine, but underlies it in all of the drill holes, and since it appears to have replaced the seam beyond a fault in the face of the main tunnel, a certain area of the seam ahead of the workings must be affected in the zone of intersection. There is however, no indication of the extent of this zone.

(*e*) (?) Rob Roy Seam.

In each of the drillholes the lowest seam reached is a highly banded seam attaining in places a thickness of over 50 ft. It is not at all workable and consists mainly of carbonaceous shale and inferior coal in bands a few inches thick. In N.S. 113 and N.S. 114 about seven feet have been replaced by a dolerite sill. For a few feet above and below the intrusion the coal plies have been coked and the shale bands rendered hard and brittle. A notable feature which assists in identification of this seam is the presence of numerous bands of fawn shale. This is apparently the same seam as that encountered in two of the Swanbank Lagoon drillholes at a similar position in the stratigraphic sequence. Since the latter seam was considered by A. K. Denmead (1955B) on the evidence of the Swanbank Lagoon drilling to be possibly identical with the Rob Roy, the same correlation is followed here.

6. Description of Coal.

In rank the coal belongs to the high volatile bituminous group. Fixed carbon values on a dry mineral-matter-free basis, calculated for all samples subjected to proximate analysis by using the Parr Formula, average 64·9 per cent. For the Bluff Seam (3 samples) the average fixed carbon value is 64·0 per cent. (range 63·7 per cent. to 64·3 per cent.).

In the Wright Seam (4 samples) the figure, namely 67·4 per cent. (range 67·1 per cent. to 68·0 per cent.), is for some undetermined reason slightly greater than in the Bluff and Lagoon Seams.

In the Lagoon Seam (15 samples) the fixed carbon values on the same basis average 65·1 per cent. (range 63·8 per cent. to 66·4 per cent.).

Moisture content varies between 1·9 per cent. and 2·5 per cent. and averages 2·2 per cent. Sulphur averages 0·28 per cent., the limits being 0·18 per cent. and 0·43 per cent.

With respect to calorific value, coal carrying 25 per cent. ash would produce an average of about 10,300 B.T.U. per lb.

Washability tests at specific gravities of 1·4, 1·6 and 1·8 were carried out on the samples from the Wright and Lagoon Seams, and the results are set out in Table 1.

7. Reserves.

The area within which reserves exist is defined by a line embracing all the drillholes presenting a workable coal section in the particular seam and lying five chains beyond the outermost of such drillholes, provided there is no evidence to the contrary. Reserves in this area have been treated as an extension of the reserves proved by drilling in the adjacent P.D.T.S. No. 3 Mine Area and have therefore been estimated only as far as the boundaries of that area. Except where otherwise stated, figures quoted represent the total tonnage of coal *in situ* as measured by drilling and mining, but excluding pillar coal.

(*a*) Bluff Seam.

Coal of workable quality exists in parts of the Bluff Seam, as set out above, but since there are not sufficient points of observation for an area to be described, reserves cannot be estimated. The quantity of coal indicated would in any case be comparatively small.

(*b*) Wright Seam.

The absence of the Wright Seam from the sequence in N.S. 112 in spite of workable sections in N.S. 113, N.S. 117 and N.S. 116 makes reliable estimation of reserves difficult. Since the section in N.S. 114 contains more than 30 per cent. ash it is excluded from reserves. The comparatively poor quality of the seam in the shaft near Southern Cross No. 8 Tunnel precludes the extension of reserves to the outcrop. The area delineated on Figure 2 covers 55·0 acres and encloses measured reserves amounting to 450,000 tons. Based on only three-seam sections, the workable thickness averages 4 ft. 3 in. and the ash content 24 per cent. The average specific gravity is taken as 1·520.

(*c*) Lagoon Seam.

Measured reserves as outlined on Figure 2 amount to 3,120,000 tons and underlie an area of 141·9 acres south-west of the present operating colliery. Within this area the thickness of the workable section of the seam averages 11 ft. 4¼ in. and the average ash content is 27·2 per cent. Specific gravity is estimated at 1·525. These figures have been derived from those drillhole sections containing 30 per cent. ash or less over the full sampled section, with the exception that the bottom 1 ft. 3½ in. in N.S. 112, containing as much as 37·0 per cent. ash, has been ignored. No allowance has been made for coal which may be affected by intrusion of the sill.

From the results of the washability tests it is estimated that if the coal extracted from this seam were washed at specific gravity 1·8, 21 per cent. would be rejected and the remaining product would have an ash content of 17·7 per cent. However, if the specific gravity cut-off were raised to a higher value a satisfactory marketable product could still be produced, and the net tonnage would thereby be increased.

It should be noted here that in several cases the top or bottom section of the seam contains slightly more than 30 per cent. ash. If these sections be excluded from the estimate, reserves *in situ* would be reduced to 2,390,000 tons with a corresponding reduction of ash to 25·9 per cent., of the average workable thickness to 9 ft. 2 in. and of the estimated specific gravity to 1·513.

Reserves additional to those already proved may exist in the Lagoon Seam in the area immediately south of that already drilled.

8. Conclusion.

Diamond drilling undertaken in the area south-east of P.D.T.S. No. 3 Mine Area to determine reserves in the Lagoon Seam in this direction has provided information necessary for the projected development of Southern Cross No. 9 Colliery on that seam. A 600-ft. thickness of the Blackstone "Stage" penetrated showed the usual seam sequence known to exist in this southern part of the Bundamba mining district. Reserves have been proved in two of the seams, the Wright and the Lagoon.

In the Wright Seam "measured" reserves amount to 450,000 tons containing an estimated 24 per cent. ash in a section of the seam averaging 4 ft. 3 in. in thickness.

In the Lagoon Seam "measured" reserves amount to 3,120,000 tons containing 27·2 per cent. ash in a workable section of 11 ft. 4¼ in. Washability tests on drill core samples at a maximum specific gravity of 1·8 indicate that the quality of the coal would be greatly improved by washing; but a greater tonnage of coal still of marketable quality could be produced by washing at a higher specific gravity.

References.

Denmead, A. K., 1955A. "The West Moreton (Ipswich) Coalfield." Geol. Surv. Q'land. Pub. No. 279.

———————1955B. "Coal Resources, West Moreton (Ipswich) Coalfield. Part 1. P.D.T.S. Nos. 1, 2, and 3 Mine Areas, Swanbank Lagoon." Geol. Surv. Q'land. Pub. No. 280.

McKenzie, A. M., 1952A. "Inspection of Trial Shaft near Southern Cross No. 8 Colliery." Unpublished report dated 29th July, 1952.

———————1952B. "Prospecting for Coal near Southern Cross No. 8 Colliery." Unpublished report dated 24th September, 1952.

TABLE I.

WASHABILITY TESTS.

Seam.	Drillhole No.	G.S. No.	Ash. %	Floats S.G. 1·4.		Floats S.G. 1·6.		Floats S.G. 1·8.		Sinks S.G. 1·8.		Composite of Floats Ash. %
				Weight. %	Ash. %	Weight. %	Ash. %	Weight. %	Ash. %	Weight. %	Ash. %	
Lagoon Top Section	N.S. 112	60/55	32·2	47·4	8·6	20·8	23·6	7·0	47·7	24·8	72·8	16·1
Lagoon Middle Section	N.S. 112	61/55	24·6	54·9	8·2	20·9	25·7	10·3	56·4	13·9	69·5	16·7
Lagoon Bottom Section	N.S. 112	62/55	37·0	39·5	11·3	23·0	26·0	12·5	46·5	25·0	79·6	21·5
Lagoon Top Section	N.S. 113	172/55	24·8	*	*	*	*	*	*	*	*	*
Lagoon Middle Section	N.S. 113	173/55	27·1	40·7	7·1	28·9	23·4	9·3	40·5	21·1	65·8	16·8
Lagoon Bottom Section	N.S. 113	174/55	33·8	39·7	7·6	26·3	25·4	8·7	45·7	25·3	76·1	18·2
Lagoon Top Section	N.S. 114	175/55	30·9	35·7	6·8	27·9	23·7	9·9	46·0	26·5	71·8	17·6
Lagoon Middle Section	N.S. 114	176/55	21·9	*	*	*	*	*	*	*	*	*
Lagoon Bottom Section	N.S. 114	177/55	29·5	44·2	7·9	27·5	25·5	7·8	47·4	20·5	73·5	18·1
Lagoon Top Section	N.S. 116	178/55	33·8	31·7	12·6	32·6	26·4	15·8	44·4	19·9	71·3	..
Lagoon Middle Section	N.S. 116	179/55	28·7	40·1	6·8	28·9	23·9	9·0	43·0	22·0	71·2	17·4
Lagoon Bottom Section	N.S. 116	180/55	28·2	41·4	7·3	27·1	23·1	7·3	45·4	24·2	71·2	16·7
Lagoon Top Section	N.S. 117	181/55	25·0	*	*	*	*	*	*	*	*	*
Lagoon Middle Section	N.S. 117	182/55	25·7	45·6	7·2	29·7	24·3	7·9	43·5	16·8	68·6	16·9
Lagoon Bottom Section	N.S. 117	183/55	29·5	41·7	7·3	27·4	25·4	8·7	43·8	22·0	74·4	18·0
Lagoon Wright Section	N.S. 113	113/57	21·9	13·0	6·6	77·3	17·9	4·5	42·6	5·2	73·9	17·1
Lagoon Wright Section	N.S. 114	114/57	31·2	41·4	11·5	28·6	23·3	11·8	39·3	18·2	70·3	19·5
Lagoon Wright Section	N.S. 116	115/57	23·8	47·0	10·6	32·6	23·1	6·7	34·3	13·7	54·7	17·7
Lagoon Wright Section	N.S. 117	116/57	26·7	36·9	9·2	34·7	24·4	10·5	40·1	17·9	72·2	19·5

* Washability tests omitted on several samples with ash 25 per cent. or less.

FIG. 1

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

SOUTHERN CROSS No.9 MINE AREA

IPSWICH COALFIELD

Parish of Bundamba, county of Stanley, warden's district of Ipswich

Showing topography, surface geology and drillholes

To accompany report by H.R.E. Staines, B.Sc., Geologist

Topographical survey by Ewan Cowley, Asst. Surv.

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10 20

SURVEY DATA

Elevations on State datum. Grid of 20 chain co-ordinates

Meridian of grid is True North at origin, an arbitrary point, being bolt in concrete block on road near angle in Eastern boundary of sub. 1 por. 213, parish of Ipswich.

LEGEND

(?) Tertiary sediments

Bundamba Sandstone

Aberdare Conglomerate

Ipswich Coal Measures

Geological boundary :

Established, position accurate

" , " approx.

" , " concealed

Inferred, probable or indefinite

Fault :

Established, position accurate

" " approx.

" " concealed

Inferred, prob. or indef.

" " " " concealed

Seam at surface

Outcrop

Strike & dip

Adit

Shaft

Contour

Diamond drillhole ◎ N.S. 135

Percussion drillhole ◎ P.D. 5

P.D.T.S. Mine Area

Section line A——A

Colliery STHN. CROSS abandoned S.CROSS A

LOCALITY MAP

SCALE OF MILES

2½ 2 1½ 1 ½ 0 2½

P.D.T.S. No.3 MINE AREA

4000 E 6000 E 8000 E 10000 E 12000 E

10000 S 12000 S 14000 S

WRIGHT'S D.D. (approx.)

94 95 96 97 98 101 152 153

STHN. CROSS No.8 A

STHN. CROSS No.9

Air Shaft

Position of mine section

A A' B B'

N.S. 24
R.L. coll. 166·33
R.L. surf. 165·16
R.L. btm. - 632·17

N.S. 117
R.L. coll. 161·60
R.L. surf. 159·83
R.L. btm. - 492·73

N.S. 113
R.L. coll. 173·64
R.L. surf. 171·64
R.L. btm. - 1031·28

WRIGHTS P.D. 1

N.S. 112
R.L. coll. 202·38
R.L. surf. 200·85
R.L. btm. - 790·12

N.S. 116
R.L. coll. 221·30
R.L. surf. 220·80
R.L. btm. - 359·53

N.S. 114
R.L. coll. 130·31
R.L. surf. 128·35
R.L. btm. - 1033·44

WRIGHT'S No. 2 P.D.
R.L. surf. 220·00

P.D. 16
P.D. 15
P.D. 14
N.S. 153
R.L. coll. 293·90
R.L. surf. 292·13
R.L. btm. - 132·90
P.D. 5

SPARKES TUNNEL
P.D. 8
R.L. surf. 195·69

26 27 38 37 36

Showing
mine workings, limits of reserves and drillholes

SCALE OF CHAINS
10 9 8 7 6 5 4 3 2 1 0 10 20

LEGEND

Limits of estimated reserves :
Wright Seam, measured
" " , indicated
Lagoon Seam, measured
" " , indicated

Workings on Bluff Seam
" " Lagoon "
Diamond, drillhole N.S. 19
Percussion " P.D. 17
Section line A—A'
P.D.T.S. mine area
Adit
Shaft

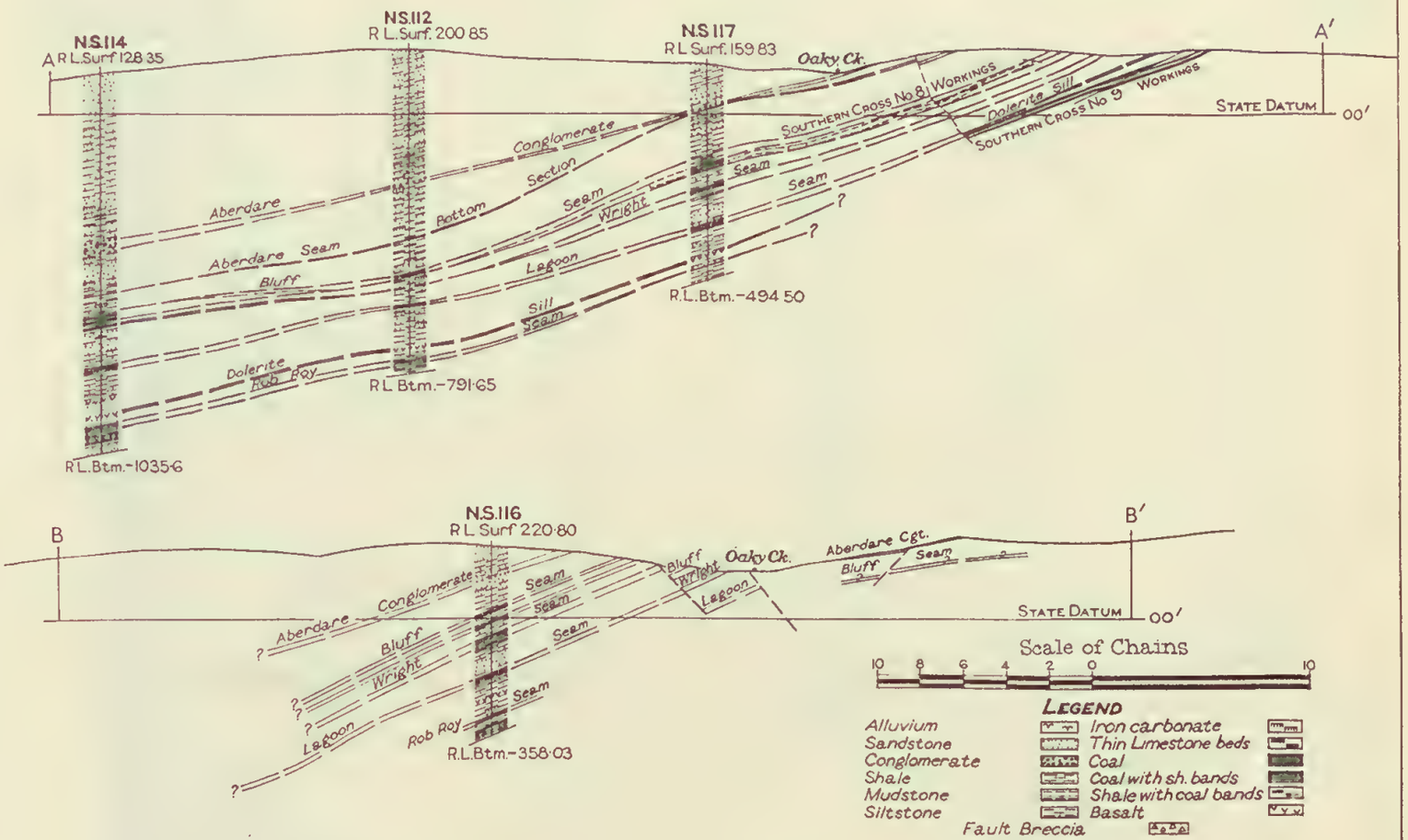
Colliery STHN. CROSS
Colliery, abandoned NEATH A
Fault in mine workings

SOUTHERN CROSS No.9 MINE AREA

FIG. 2

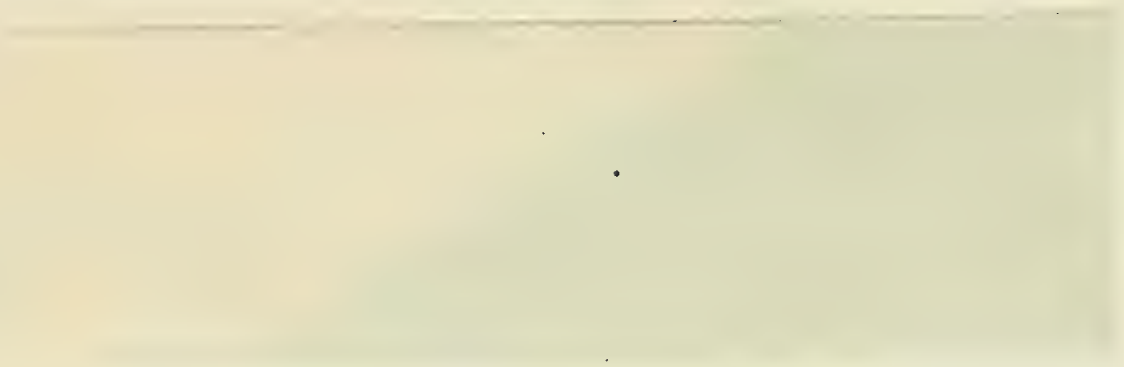
SOUTHERN CROSS MINE AREA —— CROSS SECTIONS

FIG. 3



V.B.B. 25.10.'57.

To accompany report by H.R.E. Staines B.Sc.



SOUTHERN CROSS MINE AREA — GENERALISED BORE SECTIONS

FIG.4

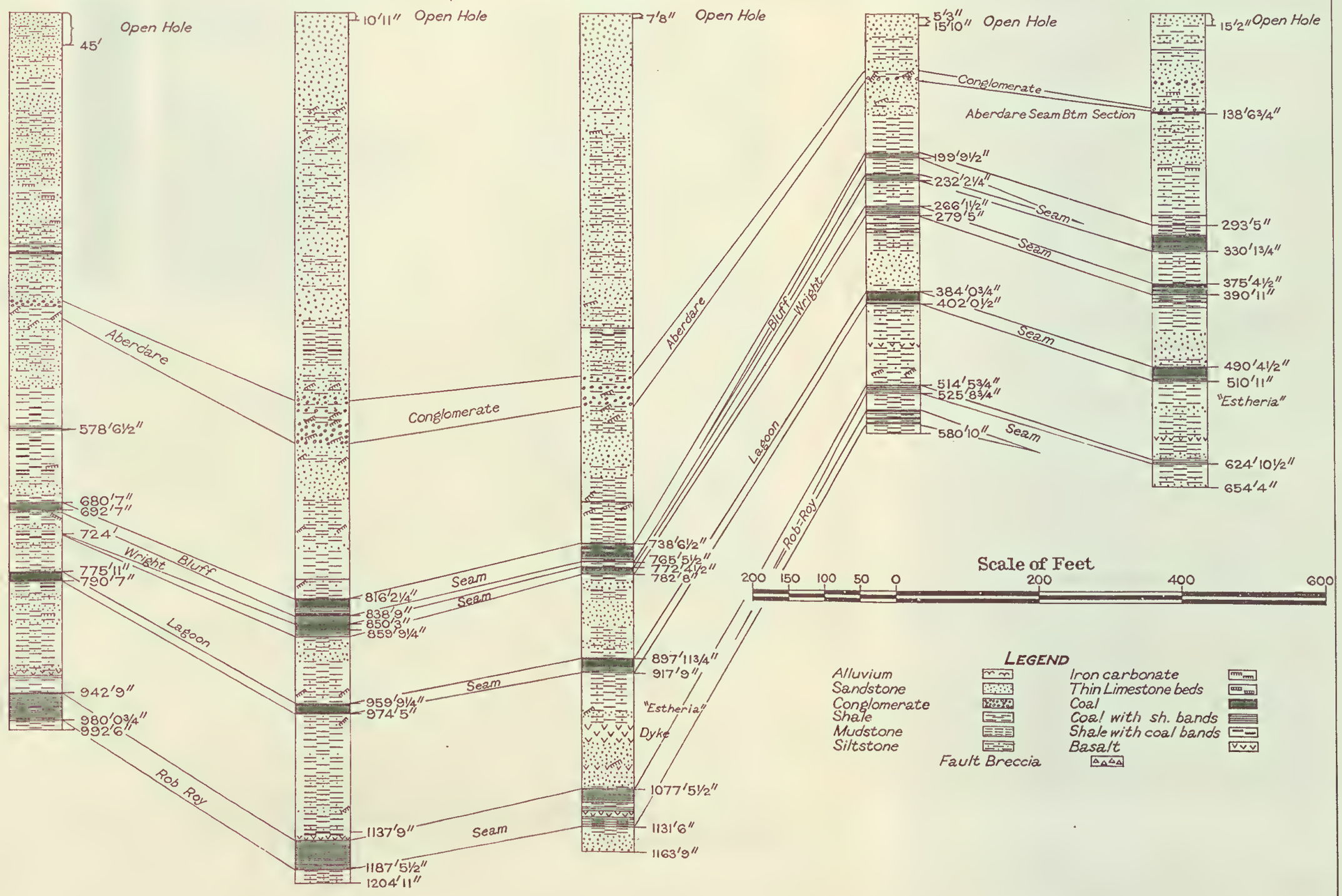
N.S.112
R.L.Surf. 200·85
R.L.Col. 202·38

N.S.113
R.L.Surf. 171·64
R.L.Col. 173·64

N.S.114
R.L.Surf. 128·35
R.L.Col. 130·31

N.S.116
R.L.Surf. 220·80
R.L.Col. 221·30

N.S.117
R.L.Surf. 159·83
R.L.Col. 161·60



V.B.B. 18.10.57.

To accompany report by H.R.E.Staines B.Sc.

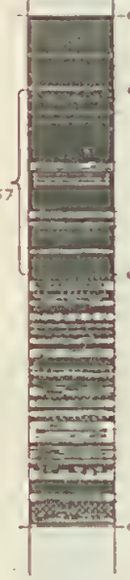
FIG. 5

SOUTHERN CROSS

BLUFF SEAM • DETAILED SECTIONS

NS.112

Prox Anal., S., Cal. value SG, Washability etc.	Recovery percent	Sections sampled
M. % 2.1 VM % 26.6 FC. % 42.5 A % 28.8 S % 0.29 Joules/gm 22080 BTU/lb 9580 SG 1.55	6824"-6866" Col. 100	118/57



Roof :- dk gy sh.

690'1"
8½" (partly broken) dull inf coal & bluey,
2" coal, ½" coaly sh with lt br parting in the mid.,
½" carb sh; 2½" coal; 1" bluey;
2½" coal, 3 ¾" inf. coal, mainly carb. sh. bdd.
682'4" (1" (bkn) coal, 1" bluey, carb sh bands; ½" coal,
½" irreg. lt-m gy sh; ½" dull coal; 1½" coal; ½" carb sh,
4" coal with few carb sh lam.; ¼" carb sh;
9" coal,
1½" med gy sh;
1½" dk gy → carb. sh.;
1½" coal with num carb sh lam. in top 4";
1½" carb sh,
1½" coal; ½" dark gy slightly carb sh;
½" coal, ½" carb sh, ½" coal, 2½" bluey, 1" bluey + coal;
3" coal, carb sh lam in btm ½", ¼" lt-med gy sh,
6¾" coal with many inf. lam.;
mid.
686'6" ½" med gy sh; 1½" inf coal; 2½" carb sh → bluey inf
1" inf coal, 1⅛" shaley coal; 1½" dk gy sh, few coal lns;
2½" coal; 1⅛" boulder,
½" coal, few iron carb nods.; ½" irreg lens boulder;
1½" coal, ½" bk sh.; ½" inf coal, few iron carb nods;
1" coal, 1½" lt gy sh, 1⅛" coal; ½" med gy sh; 1½" lam
sh with carb band at ½" from top; ½" carb sh band,
½" coal, 5½" m gy & carb sh with coal lents;
1½" (bkn) bluey & coal, 2⅛" coal, ½" m gy sh, carb sh lam
1½" carb sh with coal bds in mid., 1½" inf coal, 1½" carb sh
with few coal lam., 1⅛" coal with carb sh lam in btm ½",
½" gy sh, 1½" inf coal with gy sh lens & nodules 1" from top,
2½" gy sh with few coal lents.; 4" irr carb sh band,
½" m gy sh w carb sh bands in mid.; ½" coal, 3½" gy sh, ½" coal,
1½" bksh med gy sh lents. & w ½" coal ½" from top; ½" m gy sh
with l-m gy sh lens at btm; ½" coal; 1" carb sh; 1½" coal,
½" coal sh, 1½" gy sh, ½" carb sh,
4" coal, 2¾" carb sh with lenses dk gy sh & coal lents;
4⅛" inf coal with lenses m gy sh in btm 2", iron carb
nods, ½" m gy sh with iron carb nods; 1⅛" carb sh
with m gy sh laminae & ½" coal band at ½" from top
692'1" Floor :- dk gy sh with iron carb nodules in top 8".

Overall recovery by col. 99.1%

NS.113

Prox Anal., S., Cal. value SG, Washability etc.	Recovery percent	Sections sampled
M. % 2.3 VM % 27.1 FC. % 45.1 A % 25.5 S % 0.18 Joules/gm 23140 BTU/lb 9950 SG 1.52	819'10½"-824'5" Col. 100	119/57

Roof: wh shale.

816'2" 2½" carb sh; 2½" fawn sh.;
5½" carb sh with coal bands;
½" dk gy sh, ½" carb sh;
2" coal with carb sh laminae,
2" carb sh;
8" (partly broken) inf coal;
5" coal; ½" carb sh;
1½" dk gy sh with ½" coal at ½"; ½" dk gy sh;
½" coal, ½" carb sh;
2" (pb) coal, ½" carb sh with coal lents.; ½" dk gy sh;
819'10½" ½" coal, 5½" carb sh → inf coal, ½" dk gy sh;
2½" coal,
3½" interbed. coal & carb. sh. bands abt. ½" thick;
1'2½" (bkn) coal & a few thin bands inf coal
& ½" dk gy sh at base,
7½" (p.b) coal,
1" med gy sh,
7½" coal;
1" inf coal;
3" coal with few carb. sh. lenses; 1⅜" med gy sh.;
4⅜" (bkn) coal with one or two ¼" bds. d gy sh;
6½" coal w carb sh lam thr't & wh lacing 2½"-4" from top
824'5" ¼" lt gy sh with sl ckens. ded top & pb; sub vert. fract.
½" coal, 5⅜" carb sh with coal lents. & w ½" coal at 4";
½" coal; 8½" carb sh with few coal lents. & with
lenses of med gy sh. at ½"-1½" → inf coal at 4½"-5½"
½" coal; ½" carb sh;
1½" coal; ½" d gy sh lenses;
3⅛" carb sh with ½" coal at ½" & w sl kns'd, flt, pl. d pas
1½" coal; 4" carb sh; 1½" inf coal; ½" carb sh;
2" coal & carb sh bands, abt ½"; ¾" d gy sh,
2½" inf coal, 1" carb sh; ½" coal; 4½" carb sh with
coal lents. & with ⅜" coal at 1½",
1½" coal, ½" carb sh;
1" coal, ½" m gy sh; 3⅜" carb sh with ¼" coal at ½" & 1½"
1⅜" bk sh;
2½" coal with few carb sh lam; 1½" carb; ½" (p.b.) d gy
sh; 1" carb sh with coal lenses,
2" coal & carb sh lam.; ½" dk gy sh, 3" m bd ½" bands
coal & carb sh; 2" carb sh with l gy sh partings at 1",
2" coal with carb sh lam; 1" m gy sh;
11½" carb sh with num. coal lents. thro' out;
2⅜" bk sh; ½" carb sh;
1½" coal with few carb sh;
1" carb sh;
2½" coal; 1½" carb sh & coal;
8½" (bkn btm 1½") coal;
⅜" carb sh;
1½" coal with carb sh lam; 1½" carb sh with coal lents;
5½" carb sh with few coal lents.;
4½" (part bkn) coal with few carb sh lam.;
4" carb sh with few coal bands;
7⅛" (p.b) coal;
5⅜" inf coal with thin bands carb sh;
1½" carb sh with num. small lt br iron carb nodules,
½" coal, ½" m sh, ½" interb lenses coal & carb sh;
½" coal, ½" carb sh with small iron carb nodules,
6½" coal with few thin bands & lam. carb sh;
½" carb sh; 3" lt-med gy sh with irreg lenses l gy &
(bkn) coal; 3" inf coal; 1" bk sh;
¼" coal, 1⅜" inf coal with fine wh. lacing;
1'¾" coal, 2½" inf coal; ½" bk sh;
1'0½" (partly broken) coal with few bands + inf
coal;
838'9" 2" inf coal with ½" coal at 1½";
Floor - carb sh

Overall recovery by col 100%

NS.114

Prox Anal., S., Cal value SG, Washability etc.	Recovery percent	Sections sampled
M. % 2.2 VM % 26.2 FC. % 42.3 A % 29.3 S % 0.31 Joules/gm. 22020 BTU/lb 9470 SG 1.57	742'9"-747' Col. 100	120/57

Roof: light gy silt st. & shale.

738'6½"
10" carbonaceous shale with few coal laminae;
1'2½" dark gy slightly carbonaceous shale;
3½" carb sh with ½" coal at bottom;
1⅜" lt. gy sh., with coal & carb sh lam. in btm 1";
2½" carb sh with coal lenticles;
½" coal; 4½" (broken) inf coal;
1½" carb sh with coal lam.; 1⅜" lt gy sh.;
6" carb sh with coal laminae up to ½" wide;
742'9" 2" coal; 2½" carb sh.; ½" irreg. band m. gy sh.;
10" coal, inferior in few bands with
½" medium grey shale 2" from top;
1'10" (partly broken) coal with 5" carb sh. &
with ⅜" lt gy sh. band 12" fr. top, bottom 2" bluey;
2½" carb sh → inf. coal between ½" & ⅝" fr. top;
1½" coal; 1" carb sh with coal laminae &
few pyrite crystals, 2" lt-med gy shale;
3½" coal with carb sh laminae in bottom 1½";
5½" carb sh with few coal laminae;
½" coal; ½" dk gy sh.;
747'0" 3½" coal with ⅛" lens dk gy sh. at 2" from top;
1" inferior coal with numerous iron carb. lents.
1'1" med gy sh with few coal lents. & lam.;
1½" coaly sh.; 3" carb sh.;
3½" med gy sh with 1" fawn sh at 2" from top;
1'2" carb sh. with coal lam. from 2½" to 6½"
& from 11" to 1'2" from top;
1" med gy sh.; 1½" lt. gy sh.;
3½" carb sh with numerous coal lam.;
1½" inf coal; ½" fawn sh; 6" carb sh with coal lents.
& lam. from 4"-4⅛" from top & ⅛" gy sh at 4⅜" top;
3⅜" inf coal; 4½" dk gy sh;
½" (partly broken) coal; 1" irreg interbedded
carb & med gy sh; 2½" inf interb coal & carb sh.
1½" carb sh.; ⅝" lt. gy sh.; 3½" (partly broken) carb
sh with numerous coal lam.; ½" dk gy sh.;
1⅝" carb sh with numerous coal lam. → inf coal
in parts; 7" black slightly carb sh.; ½" carb sh.;
1⅜" coal; 1½" lt-med gy sh; 2½" inf. coal;
3½" carb sh.;
2⅜" bluey & inf. coal;
3½" carb sh with coal lam in bottom 1"; 2" bk sh; ⅜" c sh.
1⅛" coal;
3⅜" carb sh with coal lam. in top 1⅛";
⅝" coal; 1⅛" coal with calcite lacing;
1" carb sh with coal lam;
11" coal, bkn. bet 2" & 4" fr. top, carb sh bds up to
½" wide from 5"-7" from top; 1" inf coal; 1" bk sh.;
1½" carb sh with coal lam.; 1" dk gy sh;
4" carb sh with coal lam. & w d gy sh bds 1½"-3" fr. top;
2" coal; 2⅜" bluey;
1" coal with ½" boulder at 1" fr. top; ½" carb sh.;
3⅜" inf coal; 4½" carb. sh with coal lents. →
inf coal bet. 1½"-3" from top; 1" dk gy sh;
1" boulder; 1½" dk gy sh with lenses of iron carb.
6" (partly broken) coal & inf coal; a coal,
3½" fawn sh with irr. thin lenses lt. gy sh thru' out;
2½" (partly bkn) bluey;
7½" inf coal (coal with num carb sh lam.) with
lens up to 1" wide lt-m gy sh. 1" from top,
1'3½" (partly bkn) bluey with bands of bright
coal at 1½", 3", 5" 9" & 11" from top, bands av ¾"-1" w;
3½" inf coal (coal w num carb sh lam.);
2½" carb sh with num coal lam.; 1½" lt. gy sh; 2½" bluey;
2½" coal with iron carb nods. in bot 1"; 1" carb sh.;
5" inf coal;
5½" carb sh. stronly slickensided in mid. & → bluey
2" inf coal; 1½" carb sh with coal lam & lents.; bot 2";
4½" coal; 2½" lt gy sh.;
2" carb sh with coal lam. → inf coal;
2½" (partly broken) coal; 1" dk gy sh;
785'3½" 1½" inf coal.
Floor :- med gy sh with some slts lam in middle

Overall recovery by col. 99.1%

FIG. 6

SOUTHERN CROSS

WRIGHT SEAM • DETAILED SECTIONS

N.S.113

Prox Anal, S., Cal. value S.G., Washability etc.		Recovery percent	Sections sampled
A.%	21·9		
S.G.	1·50		
On comp of floats			
M. %	2·5		
V.M. %	27·0		
F.C. %	53·4	850'4"-854'1¼"	
A.%	17·1	Col. 100	113/57
S.%	0·24		
Joules/gm.	27090		
B.T.U./lb.	11650		
S.G	1·35		
W.	×		

Overall recovery by col. 100

Roof: dk gy sh
850'3"–850'4" 1" carb sh;
3½" coal with few carb sh lam, 1¼" carb sh.

19½" (p b) coal with few inf. bands up to ½";

½" dk gy. sh;

2'5" coal → inf. coal at 2½"-3½";

854'1¼" ½" carb sh; 4½" carb sh with thin coal bands, w ½" coal at 2";
2" coal with carb sh lam in btm ½"; ¾" carb sh w lt br carb nodules; 4" inf coal;
1¾" coal; ½" inf coal; 2" coal; ½" carb sh; ¼" bk. sh;
4½" coal;
1¼ carb sh with ¼" dk gy sh at 1¼
2" interbedded coal & carb sh lam; 1" dk gy sh;
3½" (p b) coal;
1½" inf coal → coal; 2¼" med gy boulder;
3½" (p b) coal; ¾" bk. sh;
4¼" coal with few thin bands carb sh; 1½" m gy sh;
2 (bkn) coal; 1" dk gy sh; 1½" lt gy sh;
2¾" coal with ½" carb sh at ¾";
3½" carb sh with coal lents, with ¼" dk gy sh at 1½";
859'9¼" 2" inf. coal; 1½" coal.
Floor: lt gy sh with coal lens at ½".

N.S.114

Prox Anal, S., Cal. value S.G., Washability etc		Recovery percent	Sections sampled
A.%	31·2		
S.G.	1·62		
On comp of floats			
M %	2·3		
V.M %	26·8		
F.C. %	51·4		
A %	19·5	772'8½"-777'3"	
S.%	0·22	Col. 100	114/57
Joules/gm.	26010		
B.T.U./lb.	11190		
S.G.	1·35		
W	×		

Overall recovery by col. 99·2

772'4½" Roof: med gy sh with some silt st. lam in middle.
772'8½" ¾" inf coal; ½" dk gy sh.; 1½" (p b.) coal;
1'0" (p b.) mainly bluey with 3" coal at top;
1'1" (p b.) coal with ¼" dk gy sh bands at 1½" & 5" from top, bluey from 9"-10";
2" bluey;
6½" coal iron carb nods & calcite lacing in btm 1";
1¼" dk gy sh.;
1'2" coal with ¼" med gy sh. 8½" from top & bluey 11½"-11" (p b) from top;
777'3" 3½" (p b) inf coal w. coal bands; 2" coal;
1" m gy sh; 1" coal; 1" lt gy sh; 1½" coal; ¾" lt gy sh;
3" coal with carb sh lam. (p b) btm 1"; ½" med gy sh.,
1¾" coal; 3½" boulder;
½" bluey;
8" coal;
½" dk gy sh; 1½" (bkn) coal; 1" inf coal w. lt gy sh partings;
coal; 1½" lt gy sh; ½" coal; 2" (p b) bluey & carb sh w coal lam,
3" lt gy sh w carb lam & ½" m gy sh band ¾" from top;
1" carb sh with irreg coal lam., 1" lt gy sh with coal lam, ¾" carb sh.,
½" lt gy sh, ¼" carb sh with num coal lam;
4" (bkn) top 2½" coal; 2½" carb sh., 3½" inf coal, shaly at top 1"
& bet. 2½" & 3" from top, ¼" carb sh,
½" coal; 1¼" carb sh; 1¼" inf. coal; ½" m.-dk gy sh,
¾" carb sh with num coal lam & lents; 3" med gy sh.; ½" carb sh.
with few coal lam; 2½" carb sh.;
4" dk gy sh with lt gy sh lam; 1¼" carb sh. with coal lam;
782'6" 1¾" (p b) coal.
Floor: regular 1" bands med gy & carb sh., coal from 5½"-6".

N.S.116

Prox Anal, S., Cal value SG, Washability etc		Recovery percent	Sections sampled
SG %	1·51		
A %	23·8		
On comp of floats:-			
M %	2·4		
VM %	26·6		
FC %	51·3	266'1¾"-270'5"	
A %	17·7	Col. 90·3	115/57
S.%	0·29		
Joules/gm	26790		
BTU/lb	11530		
SG	1·44		
W	×		
A %	38·6	270'5"-273'9¼"	
S.G.	1·66	Col. 100	117/57

Overall recovery by col. 94·4

266'1¾" Roof: med gy sh grading to dk gy sh

3'5¼" (p b) coal with canneloid coal at 4"; crushed between 10" & 14" from top; few slickensided faces; probable fault;

270'5" 6½" (p b) coal with ¼" band dk gy sh in top 2";
2½" dk gy sh;
11½" inf. coal;
5" carb sh with coal lents. in btm 2";
11" coal with several inf. bands & 1" dk gy sh at 6½";
1½" coal; 1" dk gy. sh with coal lenses;
1¼" coal with ¼" carb sh at centre; ¾" dk gy sh.;
273'9¼" 5½" (p b) inf. coal;
1½" dk gy sh
4½" (p b) coal with ¼" sh bands; 1" dk gy sh.;
3¼" coal with few lam dk gy sh & some iron carb nodules;
3¼" lt gy sh with ¾" (bkn) coal at 1¾";
2" carb sh with few coal lents;
9" (p b) coal with ½" dk gy sh. at 3";
2" dk gy sh with ½" lt gy sh. at 1";
5" carb sh with coal lenses & ½" coal at base;
4½" dk gy sh;
4¼" carb sh with ½" fawn sh at 2½" & ¾" dk gy sh at 3";
5¾" coal with lenses dk gy sh.; 1" med gy sh;
4½" carb sh w coal lents with ¼" lt gy sh at 2½" & ¼" m gy sh at base;
6" inf coal with ¼" bands dk gy sh at 3¼" & 4¾";
8¼" interbedded thin bands coal & carb sh.
279'5"
Floor: med gy nodular clay ironstone.

N.S.117

Prox Anal, S., Cal. value S.G., Washability etc.		Recovery percent	Sections sampled
A.%	26·7		
SG	1·55		
On comp of floats			
M.%	2·3		
VM %	26·8		
FC %	51·4		
A %	19·5	375'4½"-379'8¼"	
S %	0·27	Col. 97·1	116/57
Joules/gm.	26720		
BTU/lb.	11290		
SG	1·46		
W.	×		

Overall recovery by col. 99·2

375'4½" Roof: med gy sh → dk gy sh with occasional coal partings.
6½" (bkn) bluey & coal;
2" coal; ½" carb sh.; 1" (p b) inf coal; ½" carb sh;
1" coal; 1¼" (p b) inf coal; 1¼" carb sh with coal lents.;
¾" coal; ½" dk gy sh;
2¾" coal; ½" carb sh with coal lam; 1" inf. coal; ¾" dk gy sh.;
2½" (p b) coal & inf. coal;
8¾" coal with ¼" med gy sh at 3½";
1" carb sh & coal lam;
5½" coal → bluey at 3"-4½"; ½" carb sh.;
3½" coal; ¼" dk gy sh.;
7" coal → inf. coal at 2¼"-3½" with ¼" dk gy sh at 2" & 4½";
379'8¼" ¾" med gy sh; 2½" inf. coal; 1½" carb sh with coal lam;
1¼" coal; ¾" carb. sh.; ½" dk gy sh; 1½" carb sh with coal lenses;
3½" bluey;
3½" coal; ½" med gy sh; ¾" carb sh;
3½" (p b) coal; 1¼" dk gy sh;
2" inf. coal → carb sh.; ½" dk gy sh;
1½" (p b) inf coal;
9½" inf coal → coal;
1¼" dk gy sh;
3½" coal with carb sh lam in top ¼" & ¼" m gy sh at 2½";
2" dk gy sh with some carb sh lam;
6½" coal → inf coal at 3"-5½", few carb sh lam;
1" dk gy sh, 1¼" carb sh with coal lents.;
1½" coal; 2" dk gy sh with few carb lam.; 1¼" lt gy sh.
5¾" (bkn) inf coal; 1¼" carb sh;
3¼" (p b) inf coal & carb sh;
3½" carb sh with few coal lenses & ¼" fawn sh at 1¾";
1½" coal;
7" carb sh with ½" coal at ¾" & 1" coal at 2";
3¼" coal with few carb sh lam in top 1½";
¼" carb sh;
1¼" coal with ¼" carb sh at 6" & → inf. coal in bottom 3";
11½" dk gy sh, with carb sh bands & lam, the bands decreasing in thickness & number towards base, with coaly lents 6"-7";
2" bk sh; 1½" dk gy sh;
4½" carb sh with few coaly lents.;
2¾" coal with ½" carb sh at ¾";
3¼" med gy sh.; 1" inf. coal;
1½" m gy sh; 2½" inf coal → coal with ¼" dk gy sh at ¾";
1½" med gy sh; 1½" fawn sh;
2½" bluey;
390'11" 6" (p b) coal & some bluey;
Floor: dk gy sh.

× For washability tests see table 1.

FIG. 7

SOUTHERN CROSS · LAGOON SEAM · DETAILED SECTIONS

NS.112

Prox Anal, S, Cal value SG, Washability etc	Recovery percent	Sections sampled
A% 32.2 On comp of floats M% 2.0 VM% 19.0 FC% 42.7 A% 16.1 S% 0.24 Joules/gm 27875 BTU/lb 11970 SG 1.554 W ×	377½"-380½" Col 100	62½/55
A% 24.6 On comp of floats M% 2.0 VM% 22.5 FC% 51.0 A% 16.7 S% 0.21 Joules/gm 27593 BTU/lb 11860 SG 1.549 W ×	380½"-384½" Col 100	47½/55
A% 37.0 On comp of floats M% 2.3 VM% 26.9 FC% 42.3 A% 21.5 S% 0.26 Joules/gm 25690 BTU/lb 11040 SG 1.463 W ×	384½"-387½" Col 100	60½/55

Overall recovery by col 100.0

Roof:— med gy sh

[illegible] coal, carb sh, ½" gy sh, ½ coal, carb sh with coal bands (carb sh with ½ gy sh bands), 5 coal, ½" med gy sh lens,

½" (ext) coal, ½" (p b) coal, carb sh with coal,

4" int coal, vert fract),

¾" coal, of coal in parts with ½" binder of ½" coal top,

½" bony → lt coal in part with ½" carb sh bands",

½" coal, 4" gy sh with coal parting,

1'2" coal with iron carb nods fm 5½" from top,

→ carb sh in btm ½", ½" lt gy sh,

1'0" coal with lt gy sh bands at 2", 4½" from top

of ½" coal with few bands of coal & carb sh up to ½" ask vert fract, bone, overt fract thro coal,

½" med gy sh

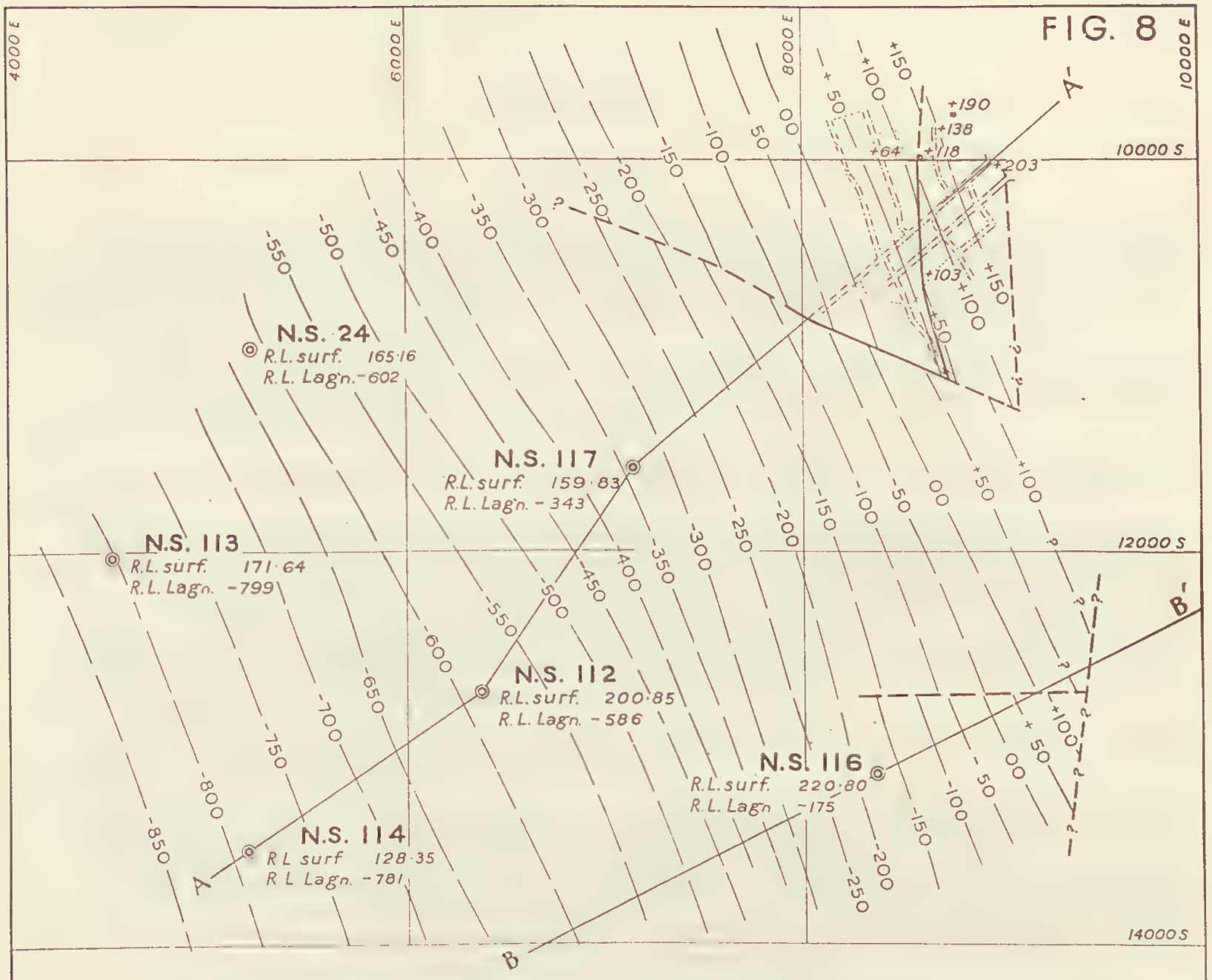
1'4" (p b) coal & inf coal with few lt gy sh coal lenses & bands at 2" (bottom),

1½" some p b coal, num iron carb nods from 6" lt gy sh at 1½" & coal → inf coal & carb sh in btm 2",

[illegible] coal, ½" just [illegible] carb sh & coal,

[illegible] coal, 4" just, ½" coal, ½" (p b) coal, carb sh with coal lam, with ½" coal, 4" just, ½" coal, ½" gy sh, ½" coal, ½" gy sh, ½" coal, ½" gy sh

FIG. 8



SOUTHERN CROSS No.9 MINE AREA

Structure contours, Lagoon Seam

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10 .. 20

Contours drawn on base of seam.
Elevations on state datum.

SUMMARY.

——o——

Drilling of five boreholes in the New Hope Colliery Area was recommended by Powell-Duffryn Technical Services Ltd. to prove reserves in the Bluff Seam. Early results showed reserves in that seam to be negligible due to rapid deterioration, and attention was transferred to the underlying Lagoon Seam.

During the period March-October, 1955, eight holes were completed and in November, 1956, a supplementary hole was drilled to obtain geological information. Depths of holes ranged from 375 ft. to 1,247 ft., aggregating 7,402 ft. 4 in.

This report, accompanied by six figures and one table, sets out the results of diamond drilling.

The succession of seams established by drilling corresponds generally with that along the south-western flank of the Bundamba Anticline. Erosion, following uplift and preceding deposition of the Aberdare Conglomerate, has extended in places to below the Bluff Seam.

Situated at the southern end of the Bundamba Anticline, the area is strongly folded and intersected by a pattern of radiating normal dip faults. This faulting will prevent economic mining at shallow depths in the north-western part of the area.

The rank of the coal is shown by analysis to be high-volatile bituminous, with average fixed carbon content (D.M.M.F.) of 64·47 per cent.

Reserves, confined to the Lagoon Seam, are presented as (*a*) coal marketable as mined and (*b*) coal available if beneficiation by washing were practised:—

(*a*) Measured reserves of coal with ash content below 30 per cent. have been calculated at 2,665,000 tons. Such reserves lie in the upper and middle sections of the seam over an area of 156·5 acres with average seam thickness of 9 ft. 2 in. Average weighted ash content is 28 per cent.

(*b*) Including also coal sections which on analysis showed greater than 30 per cent. ash, the area is increased to 197·4 acres with corresponding average seam thickness of 11 ft. 5 in. and average ash content of 30·5 per cent. On this basis measured reserves are calculated at 4,220,000 tons of mineable coal. With a discard of 22·5 per cent. on washing at specific gravity 1·8, 3,040,000 tons of marketable coal with ash content of 18·9 per cent. would be available.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

19th March, 1957.

COAL RESOURCES—WEST MORETON (IPSWICH) COALFIELD.
PART 10. P.D.T.S. No. 4 MINE AREA, NEW HOPE.

Introduction.

Powell Duffryn Technical Services No. 4 Mine Area, which embraces New Hope Colliery (originally known as Palmer's Aberdare), was drilled as part of the Mines Department diamond drilling campaign to test the coal resources of the Ipswich Coalfield.

The mine area covers the extreme south-eastern part of the Bundamba mining district, some 3½ miles SSE. of Blackstone.

In No. 4 Mine Area boreholes numbered N.S. 115, 118-124 inclusive and 153 were completed during the periods 20-3-55 to 13-10-55 and 8-11-56 to 22-11-56. They ranged in depth from 375 ft. (N.S. 122) to 1,247 ft. (N.S. 119) with an aggregate footage drilled of 7,402 ft. 4 in. Three drills, viz., Failing 2500, Sullivan 200A and Joy Sullivan 37 were employed during the campaign.

No. 4 Mine Area was planned to develop the Bluff Seam but early drilling showed this seam to deteriorate rapidly beyond the limits of existing mine workings, making it necessary to drill to the Lagoon Seam to prove workable coal.

The P.D.T.S. proposal called for five boreholes in the area but because of present lease conditions it was decided to drill two additional holes (N.S. 121, 122) in the south-western portion of the mine area. In addition N.S. 124 was drilled to provide a section of the Lagoon Seam near N.S. 115 in which it was absent because of faulting, while N.S. 153 was drilled to determine the depth to the Lagoon Seam at that location.

At the time of writing a new tunnel which was being developed to exploit the Lagoon Seam had not reached the seam.

This report is accompanied by the following plans and sections:—

Fig. 1.—A map showing P.D.T.S. No. 4 Mine Area, survey grid, surface contours, bore locations, surface geology and a locality map.

Fig. 2.—A map showing P.D.T.S. No. 4 Mine Area, survey grid, bore locations, underground workings and a locality map.

Fig. 3.—Generalised bore sections.

Fig. 4.—Diagrams showing detailed sections of Lagoon Seam in boreholes with core recoveries and analytical data.

Fig. 5.—Three cross sections.

Fig. 6.—Skeleton plan showing structure contours on the Lagoon Seam.

Geology.

The typical shales, siltstones and fine-grained sandstones of the upper part of the Ipswich Coal Measures form scattered outcrops in the area but coal crops can rarely be located except at shafts and adits. Disconformably overlying the Coal Measures is the Aberdare Conglomerate which is readily mappable as persistent though lenticular outcrops. This formation is conformably overlain by sandstone, siltstone and shale beds which for the present are assigned to the lower part of the Bundamba Sandstone. Above this variable lithologic succession is a massive sandstone, typical of the Bundamba Sandstone.

Sediments probably of Tertiary age unconformably overlie the Ipswich Coal Measures in the western part of the area.

Tertiary.

A small area of conglomerate and sandstone presumably Tertiary in age unconformably overlies the Blackstone "Stage" (Denmead, 1955A) in the SW. corner of portion 153, parish Bundamba. This conglomerate differs from the Aberdare Conglomerate in that it has an argillaceous matrix as compared to the siliceous and ferruginous matrix of surface exposures of Aberdare Conglomerate. In places the coal measures have been tilted to 45 deg. by faulting resulting in a marked angular unconformity where the relatively flat lying Tertiary sediments are superimposed on them.

Bundamba Sandstone.

There are indications from both bore cores and surface exposures that the Bundamba Sandstone consists of two distinct lithologies in this area. The lower section approximately 410 ft. thick consists of interbedded shale, siltstone and fine to coarse grained sandstone which often has a siliceous matrix, especially at outcrop. One carbonaceous shale horizon is known towards the base of the formation.

Overlying this succession is a massive white sandstone which attains a maximum thickness of 350 ft. in N.S. 119. This sandstone consists essentially of sub-rounded to rounded quartz grains in an argillaceous cement which breaks down rapidly on exposure. This accounts for the wide spread of coarse sand which covers the surface in the outcrop area of this sandstone. Isolated outcrops occur only where a more resistant cementing material is present. The white colour is characteristic of samples of the sandstone from bore cores but surface exposures are usually ironstained.

Aberdare Conglomerate.

Uplift in this area was more pronounced than in other parts of the basin since erosion preceding the deposition of the Aberdare Conglomerate extended to, and sometimes through, the Bluff Seam. The Aberdare Seam, if it was laid down in the area, has been completely eroded.

The Aberdare Conglomerate at outcrop is a very siliceous usually fine conglomerate with siliceous sandstone and thin shale beds. The conglomerate beds are noticeably lenticular and the individual lenses are rarely more than 10 ft. thick. The formation attains a maximum thickness of 60 ft. in N.S. 123 (see Figure 3).

The disposition of the numerous conglomerate outcrops in the area can be attributed to the severe faulting found on the nose of the Bundamba Anticline.

Blackstone "Stage".

The Blackstone "Stage", consisting of shale, siltstone, fine sandstone and coal beds, was 460 ft. thick in N.S. 120, but this thickness was reduced to 360 ft. in N.S. 153.

A characteristic pinkish-grey shale with iron carbonate needles and grains often occurs immediately below the Aberdare Conglomerate and in this area is associated with the upper part of the Blackstone "Stage". This shale member is lithologically identical with the pink shale reported from the Blackheath area (Hawkins, 1958).

In N.S. 119, the most easterly bore in the area, the identity of some coal seams is doubtful (Figure 3). The ? Lagoon Seam is underlain by a coarse sandstone which in part resembles the typical coarse Cooneana sandstone. If this is the Cooneana "Stage" a pronounced thinning of the Blackstone "Stage" caused by the non-deposition of the lower members of the formation including the Rob Roy Seam has occurred in this area.

The Coal Seams.

The succession of seams in the area follows that established along the south-western flank of the Bundamba Anticline and is:

Bluff Seam
Wright Seam
Lagoon Seam
(?) Rob Roy Seam.

A coal seam outcropping at Sparkes' Tunnel in portion 98, parish Bundamba, has not been definitely identified. The seam prospected in this tunnel is 4 ft. 1 in. thick and as sampled at the face carried 26·9 per cent. ash. From the driller's logs of company percussion bores numbers 8, 9 and 10 drilled in the environs of Sparkes' Tunnel it appears that 4 ft.–5 ft. of coal measures overlie the 4 ft. of roof shale visible at the tunnel entrance. The seam is overlain by 25 ft. of shale which in turn is overlain by the Aberdare Conglomerate.

If this seam is portion of the Aberdare Seam it is the only occurrence of that seam known from boreholes and from outcrop in the New Hope and the southern portion of the Southern Cross No. 9 Colliery areas. This seam may be part of the Bluff Seam which is known to split and deteriorate in the area around Southern Cross No. 8 Colliery. On the other hand the Bluff Seam is not split and shows a typical Bluff section in New Hope No. 2 Tunnel only 9 chains to the east of Sparkes' Tunnel and only 4 chains east of Nos. 9 and 10 percussion drill holes.

Bluff Seam.

This seam has been worked from New Hope Nos. 1 and 2 Tunnels. No. 2 Tunnel workings probed various sections of the seam in search of workable coal but although No. 1 Tunnel drifted through the "tops" i.e. above the white shale marker band, near the entrance only the upper part of the "bottom" coal was worked. The "top" coal is approximately 5 ft. 8 in. thick in No. 2 Tunnel. The roof is variable, sometimes coaly shale, sometimes shale, while in places the seam has been eroded and sandstone forms the roof. A light-grey shale band 2½ in. thick occurs 1 ft. above the Bluff "yellow" shale marker band which divides the "tops" from the "bottoms". The marker band varies in thickness from 2 in. to 2 ft. but is usually 8 in. thick. Sometimes it is a light-grey shale while in other places the better known "yellow" or fawn shale band is visible.

In No. 1 Tunnel the "top" coal, of inferior quality, is less than 5 ft. thick. The "bottoms" consist of 1 ft. 4 in. coal with lenticular shale bands, 2 in. light-grey shale, 2 ft. 6 in. coal with shale bands, 1 in. dark shale, 9 in. coal and a coaly shale floor. The average thickness worked is 4 ft. 10 in.

The seam is extremely banded and the overall quality is so poor that abandonment of the workings is imminent at the time of writing.

The seam was represented by 15 ft.–25 ft. of interbedded coal, carbonaceous shale and shale in the eight boreholes in which it was penetrated. It was unworkable except in N.S. 122 which penetrated a pillar in No. 2 Tunnel workings. The seam was faulted out of N.S. 120; and since the Wright was the first seam penetrated in N.S. 123, the Bluff Seam has apparently been removed by erosion prior to deposition of the Aberdare Conglomerate.

Wright Seam.

The Wright Seam was encountered in N.S. 115, 118, 119, 123, 124 and 153 at an average interval of 75 ft. below the pavement of the Bluff Seam. It was usually represented by a coaly shale horizon except in N.S. 119 where a possibly workable coal section approximately 10 ft. thick existed at 846 ft. As this was an isolated occurrence no analysis was carried out. The seam was not present in the shallow bores and it has been found at outcrop only to the north of Hare and Wall's Tunnel.

Lagoon Seam.

This seam occurred in eight boreholes at an average interval of 235 ft. below the Bluff Seam. The interval varied from 165 ft. in N.S. 153 to 260 ft. in N.S. 124. The seam was characterised by an upper banded coaly section 3 ft. to 7 ft. thick which was invariably separated from the workable part of the seam by from 2 ft. to 25 ft. of shale and siltstone. This split in the seam is also visible in a shaft on the seam outcrop in the roadway near the north-west corner of portion 153, Bundamba.

The workable portion of the Lagoon Seam carries a large number of ½-in.–2-in. shale bands none of which can be correlated accurately from bore to bore. The workable thickness varies from 9 ft. 3½ in. in N.S. 153 to 14 ft. 2½ in. in N.S. 121 and averages 11 ft. 5 in. A rough division of the workable section into top, middle and bottom portions is generally possible and where this practice was carried out in sampling it was found that the middle portion, which averaged 7 ft. 1 in. in thickness, was the best coal section carrying usually less than 30 per cent. ash. Overall analytical results indicate that in most cases the full seam thickness could be worked successfully if beneficiation by washing at specific gravity of 1·8 were carried out.

Rob Roy Seam.

Boreholes N.S. 120 and N.S. 153 penetrated to the bottom seam of the Blackstone "Stage" which is again tentatively correlated with the Rob Roy Seam (Denmead, 1955B). This seam was found 200 ft. and 150 ft. below the pavement of the Lagoon Seam in N.S. 120 and N.S. 153 respectively. A noticeable feature was the large number of fawn shale bands in the seam—the same occurrence being recorded in the Southern Cross No. 9 Colliery area.

The seam was over 20 ft. thick in N.S. 120 but did not contain a workable section.

In N.S. 153 a basic intrusive, probably a dolerite sill, had coked the upper part of the seam which was 19 ft. thick overall, and contained alternating shale and coal bands throughout.

Some 30 ft. below the seam pavement a coarse sandstone, characteristic of sandstone of the Cooneana "Stage", was encountered in both boreholes.

Mullins' Bore.

A diamond drill hole known as Mullins' Bore was put down in the vicinity of portion 161, Bundamba, in 1926. Its position cannot be accurately established. It reached the Bluff Seam at 535 ft., the horizon of the Wright Seam at 600 ft. and the Lagoon Seam at 786 ft. The section of this bore is included in Figure 3 for record purposes.

Company Percussion Bores.

A series of sixteen percussion bores drilled by New Hope Colliery prospected the Company's lease for coal seams, in particular the Lagoon Seam.

Cuttings from some of these bores were logged by the writer several months after the drilling was completed but because of lack of accurate depth checks and inconsistencies in detailed descriptions these bores have been of little value in the preparation of this report.

Geological Structure.

Folding.

The outcrops of the coal seams and levels in the mine workings reflect a pronounced anticlinal structure—the Bundamba Anticline—the axis of which strikes slightly west of north and pitches gently to the south. The eastern flank dips at 7 deg. near the axis but turns over sharply further down dip where surface dips of up to 30 deg. are registered on outcrops of Bundamba Sandstone. Surface evidence obtained from outcrops in this formation indicates further folding to the east of the main structure while the Lagoon Seam structure contour plan (Figure 6), shows a syncline with axis pitching to the north-north-east, roughly along a line through N.S. 124 and N.S. 119. Further folding occurs east of this line but no detailed mapping was carried out.

Faulting.

A well defined pattern of normal dip faults striking between south-south-east and east-south-east and radiating from an apical area in the north-west corner of the mine area has been established. Surface mapping indicates that displacement on the faults decreases down dip within the mine area. The faults which dip between 80 deg. and vertical have relatively small throws such as 15 ft. on the fault between Nos. 1 and 2 Tunnels and 40 ft. on the fault forming the northern limit of No. 1 Tunnel workings.

This fault system has apparently dislocated an earlier north-east–south-west striking fault of considerable magnitude. Initial displacement along the latter fault, with subsequent redistribution by the north-west striking faults has contributed to the widely scattered outcrops of Aberdare Conglomerate in the area. The actual location of the major north-east striking fault is unknown but it must lie between N.S. 153 and No. 1 Tunnel. The throw on it in this area is calculated at 170 ft.

A major fault striking north-north-west limits No. 2 Tunnel workings in a westerly direction. A short stone drive beyond the fault, which is vertical, entered soft white medium to coarse grained sandstone dipping to the south-west at 45 deg. Surface dips in this zone which can be traced into the north-west corner of the mine area are of the order of 40 deg. to the south-west. To the west of this zone the strata are practically horizontal for a short distance and then dip over to the south-west at about 15 deg.

A narrow weathered basic dyke has been traced in the No. 2 Tunnel workings along a course approximately parallel to the direction of the fault penetrated by the stone drive and one chain east of it.

Coal Evaluation.

High core recovery throughout the drilling campaign enabled accurate evaluation of the coal to be made. The core recovery in the Lagoon Seam averaged 98 per cent.

The coal is high volatile bituminous in rank, typical of the coals of the Bundamba mining district. No mine is at present working the Lagoon Seam in P.D.T.S. No. 4 Mine Area although Binnie's Tunnel to the north is on this seam. All results are determined from diamond drill cores which indicated that workable coal existed only in the Lagoon Seam.

The dry-mineral-matter-free fixed carbon values of 18 samples from the Lagoon Seam ranged from 59·95 per cent. to 67·90 per cent. with an average value of 64·47 per cent. Sulphur content varied from 0·22 per cent. to 0·33 per cent. while the moisture content ranged between 1·8 per cent. and 2·8 per cent.

Calorific value of coal containing 25 per cent ash is approximately 10,200 B.T.U. per lb.

The average ash content of the Lagoon Seam was 30·50 per cent. Washability tests were carried out on all samples with an ash content over 25 per cent. The results of these washability tests are included in Appendix I. Proximate analyses were carried out on the composites of the floats from the washability tests and these results are shown along with the diagrams of the detailed Lagoon Seam sections (Figure 4).

Coal Reserves.

In calculating measured reserves an arbitrary limit of five chains has been placed on the extent of workable coal beyond an outer borehole. The unavailability of coal due to faulting or because of lease boundaries has been disregarded, and no allowance has been made for loss in mining.

Total reserves have been calculated in two categories—(*a*) using coal sections containing less than 30 per cent. ash as sampled from bore cores, and (*b*) including also sections with higher ash values which after washing at a specific gravity of 1·8 had their ash content reduced to less than 25 per cent. by discarding 25 per cent or less of the samples.

1. Bluff Seam.

No measured reserves exist. Coal is being mined in New Hope No. 1 Tunnel on the Bluff Seam but it is proposed to close this mine as production commences on the Lagoon Seam.

2. Lagoon Seam.

Measured reserves in category (*a*) i.e. coal with an ash content below 30 per cent. have been calculated over an area of 156·6 acres, which encloses all boreholes with the exception of N.S. 115, N.S. 119 and N.S. 153.

In general, they occur in the middle and upper sections of the seam. The average seam thickness is 9 ft. 2 in.; the weighted ash content averages 28 per cent., and the corresponding specific gravity is 1·536. Reserves have been calculated at 2,665,000 tons.

Measured reserves in category (*b*) extend over 197·4 acres with an average seam thickness of 11 ft. 5 in. The weighted ash content of this coal as mined is 30·5 per cent. with specific gravity 1·561. Reserves in this category have been calculated at 4,220,000 tons. Washability tests show that a discard of 22·5 per cent. at specific gravity 1·8 would result in a product having an ash content of 18·9 per cent. and a specific gravity of 1·446. Reserves of marketable coal are therefore calculated at 3,040,000 tons.

Conclusion.

Drilling of P.D.T.S. No. 4 Mine Area has proved 4,220,000 tons of mineable coal in the Lagoon Seam, some of which has an ash content over 30 per cent. By washing this coal at a specific gravity of 1·8, a yield of 3,040,000 tons of coal carrying 18·9 per cent. ash would be obtained.

Reserves of coal carrying less than 30 per cent. ash as mined amount to 2,665,000 tons with a weighted ash value of 28 per cent.

The area in which reserves have been measured has not been extended to the seam outcrop and embraces boreholes only.

References.

Denmead, A. K., 1955A.—"The West Moreton (Ipswich) Coalfield." Geol. Surv. Q'land. Pub. No. 279.

————————1955B.—"Coal Resources, West Moreton (Ipswich) Coalfield" Parts 1 and 2. Geol. Surv. Q'land. Pub. No. 280.

Hawkins, B. W., 1958.—"Coal Resources, West Moreton (Ipswich) Coalfield." Part 8. Geol. Surv. Q'land. Pub. No. 288.

APPENDIX.

Table of Washability Test Percentages.

Lagoon Seam.

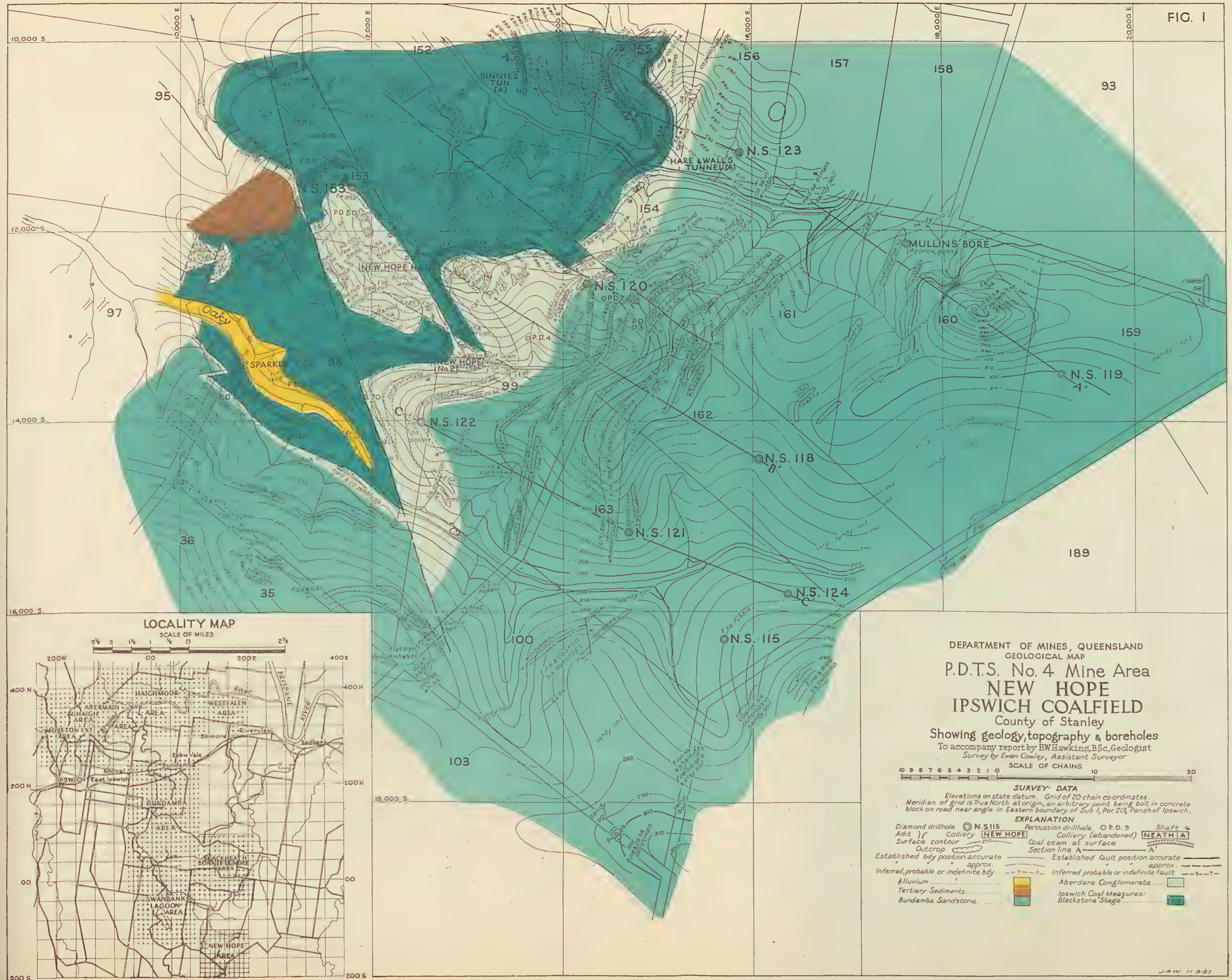
Bore No.	N.S. 118.			N.S. 120.			N.S. 121.			N.S. 122.		
Sample No.	262/55.	263/55.	264/55.	265/55.	266/55.	267/55.	268/55.	269/55.	270/55.	271/55.	272/55.	273/55.
Ash on original sample	29·6	31·2	45·3	44·8	30·0	29·6	31·6	26·2	43·2	36·0	26·6	37·6
Floats at 1·4 sp. gr.	31·2	39·1	20·8	*a*	33·3	40·6	32·9	45·8	25·4	27·7	44·4	28·7
Ash	7·8	6·6	8·6	..	7·7	7·0	6·9	6·2	6·5	6·7	6·2	7·9
Floats at 1·6 sp. gr.	34·2	30·3	20·0	..	32·6	28·6	35·1	29·1	24·4	29·3	27·1	26·4
Ash	22·3	23·2	21·9	..	22·6	22·8	21·7	22·6	25·2	24·5	24·7	25·4
Floats at 1·8 sp. gr.	10·1	7·7	7·3	..	9·1	8·2	8·6	8·2	9·6	13·2	8·9	13·7
Ash	41·2	40·6	37·1	..	41·4	40·2	40·1	41·7	40·8	39·4	39·7	42·7
Sinks at 1·8 sp. gr.	24·5	22·9	51·9	46·8	25·0	22·6	23·4	16·9	40·6	29·8	19·6	31·2
Ash	74·2	74·1	76·4	65·5	73·8	72·0	73·2	71·4	71·9	71·6	69·3	72·7

Bore No.	N.S. 123.			N.S. 124.		N.S. 153.	
Sample No.	376/56.	377/56.	378/56.	386/55.	387/55.	3/57.	4/57.
Ash on original sample	19·0	38·3	25·7	31·8	28·8	33·5	42·3
Floats at 1·4 sp. gr.	*b*	30·3	46·5	36·0	34·7	50·0	29·4
Ash	..	11·5	13·4	7·2	6·2	9·7	10·8
Floats at 1·6 sp. gr.	..	17·1	16·6	28·4	29·3	20·2	15·1
Ash	..	29·1	26·5	23·4	23·6	28·5	25·0
Floats at 1·8 sp. gr.	..	16·1	15·1	10·2	11·2	8·7	16·6
Ash	..	43·5	33·6	42·3	43·2	43·0	42·7
Sinks at 1·8 sp. gr.	..	36·5	21·8	25·4	24·8	21·1	38·9
Ash	..	64·7	65·6	74·2	70·4	73·9	77·7

a Figures not received from Government Analyst.
b Sample contains less than 25 per cent. ash.

A. H. Tucker, Government Printer, Brisbane.

FIG. 1



LOCALITY MAP

SCALE OF MILES

DEPARTMENT OF MINES, QUEENSLAND
GEOLOGICAL MAP

P.D.T.S. No. 4 Mine Area
NEW HOPE
IPSWICH COALFIELD

County of Stanley

Showing geology, topography & boreholes

To accompany report by B.W. Hawking, B.Sc., Geologist
Survey by Ewen Cowley, Assistant Surveyor

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10 20

SURVEY DATA

Elevations on state datum. Grid of 20 chain co-ordinates. Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of Sub 1, Por. 213, Parish of Ipswich.

EXPLANATION

Diamond drillhole ◎ N.S.115 — Percussion drillhole O P.D.9 — Shaft
Adit — Colliery NEW HOPE — Colliery (abandoned) NEATH A
Surface contour 210 — Coal seam at surface
Outcrop — Section line A — A'
Established bdy position accurate — Established fault position accurate
" " approx. — " " approx.
Inferred, probable or indefinite bdy. — Inferred probable or indefinite fault
Alluvium
Tertiary Sediments
Bundamba Sandstone.
Aberdare Conglomerate
Ipswich Coal Measures: Blackstone Stage

JAW 11 9 57

FIG. 2

DEPARTMENT OF MINES, QUEENSLAND

PLAN OF

P.D.T.S. No 4 Mine Area
NEW HOPE
IPSWICH COALFIELD

County of Stanley

Showing P.D.T.S. mine area, boreholes, mine workings and areas within which reserves have been estimated.

To accompany report by B.W. Hawkins, B.Sc, Geologist.

Survey by Ewan Cowley, Assistant Surveyor.

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10 20

SURVEY DATA

Elevations on state datum. Grid of 20 chain co-ordinates. Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of Sub. 1, Por 213, Parish of Ipswich.

EXPLANATION

Diamond drillhole ◎ N.S.115 — Percussion drillhole ⊙ P.D.9 — Shaft

Adit — Colliery NEW HOPE — Colliery (abandoned) NEATH A

Fault in workings — Section line A — A'

Workings on Bluff Seam, top section — Workings on Bluff Seam, bottom section

Boundaries of calculated reserves:

Lagoon Seam, less than 30% ash — Lagoon Seam more than 30% ash

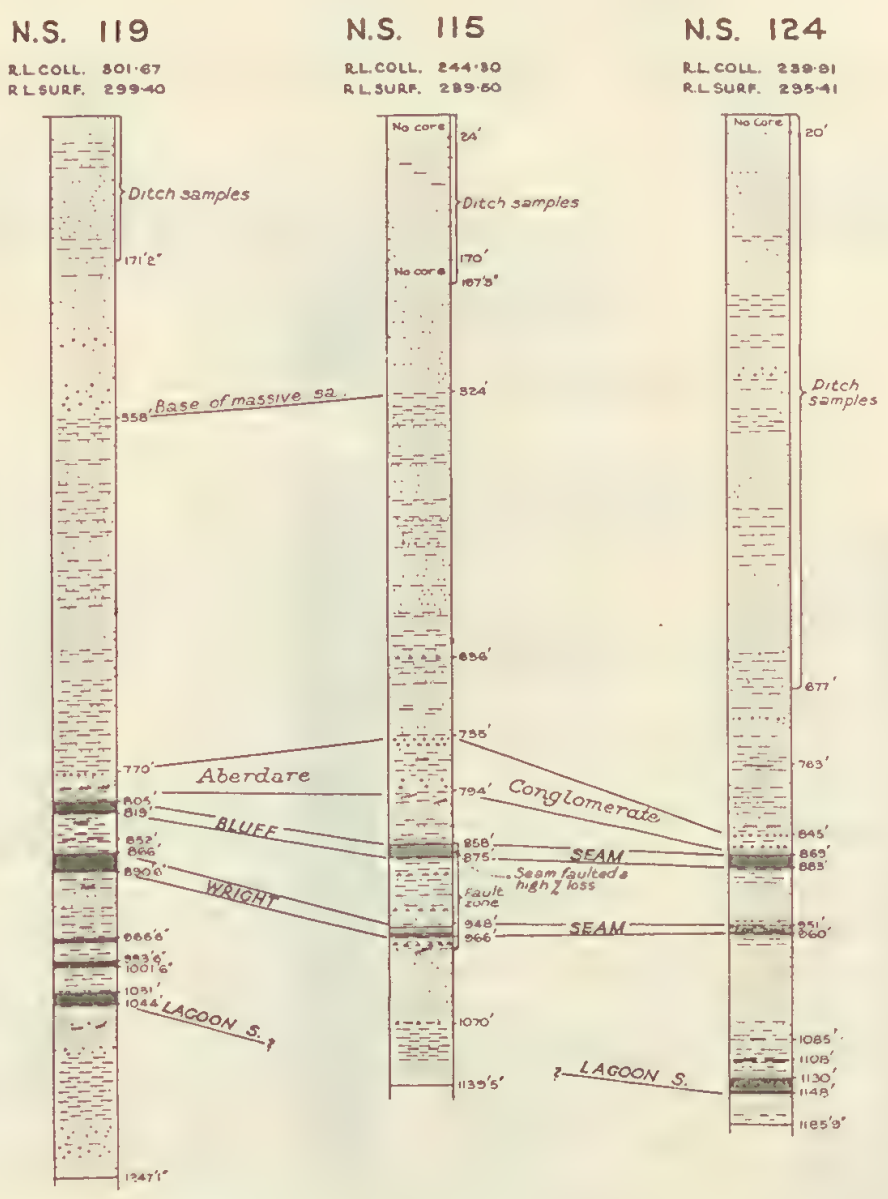


FIG. 3.

P.D.T.S. No.4 MINE AREA.

NEW HOPE

GENERALISED BORE SECTIONS

SCALE OF FEET

100 0 100 200 300 400

LEGEND

- shale
- sandstone
- conglomerate
- coal
- basaltic sill or dyke
- siltstone
- pebbly sandstone
- coal & shale bands
- iron carbonate
- fault zone

P.D.T.S. No. 4 MINE AREA — NEW HOPE — FIG. 4a

DIAGRAMS OF LAGOON SEAM • DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 121

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled
A. 31·6		
S.G. 1·678		
W. ※		
Results on comp of floats:		
M. 1·8		
VM. 28·5		
FC 51·7		
A. 18·0	99%	268/55
S 0·25		
Joules/Gm. 28,850		
BTU/lb 11,560		
S.G. 1·442		
A. 26·2		
S.G 1·519		
W ※		
Results on comp of floats:		
M 1·9		
VM 29·7		
FC. 53·1		
A. 15·3	95%	269/55
S. 0·27		
Joules/Gm 27,950		
BTU/lb 12,020		
S.G. 1·410		
A. 43·2		
S.G 1·709		
W. ※		
Results on comp. of floats:		
M. 1·9		
VM. 28·3		
FC. 48·9		
A 19·9	98·5%	270/55
S 0·30		
Joules/Gm 28,130		
BTU/lb. 11,240		
S.G 1·451		

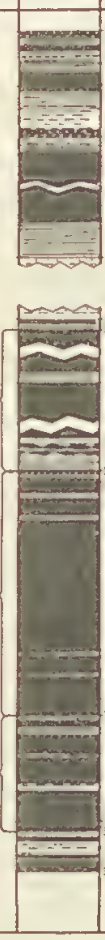
Overall recovery 98·6%

687'5½" Roof: dk gy sh;
2½" coal, 1" dk gy sh, 1½" coal, 1½" blk. sh;
3" carb. sh. w. coal lenses, 1¾" coal,
1" carb sh w coal lents;
7" inf. coal,
6½" coal;
¾" dk gy sh.; 1¾" inf coal, 1¾" carb sh. with coal lenses, impreg with $FeCO_3$, 1½" inf coal,
690'4½" 3¼" dk gy sh, ¾" inf coal,
shale, silts. & f. sa.;
705'10½" 1¼" carb sh w ¼" med. gy. sh at 1";
3½" bluey,
3¼" dk gy sh; ⅜" carb. sh,
707'1¼" 3¼" carb. sh. w. coal lenses,
2" dk gy sh, 1¼" coal,
3⅜" (broken) coal,
11½" coal w ½" med. gy. sh. at 2",
9¾" bluey,
3½" (partly bkn) coal;
2¼" med gy sh; 2" coal,
710'2¾" 1½" bluey, 1¾" carb sh. with coal lents & ⅛" dk gy. sh at ⅛; 1½" coal; 4" bluey,
1½" (p bkn) coal,
3'1½" (part broken) coal with few bluey bands ⅛-1" wide;
½" med. gy sh.,
1'0¾" (bkn) coal & bluey w ½" dk gy sh in btm. 3";
2" inf coal;
8¾" coal w ½" carb sh at 5¼";
½" dk gy sh,
6¼" coal;
½ dk. gy. sh; 1¾" coal; 1" med-dk gy sh,
1'4½" coal (bkn. btm 4"), dip 18°,
718'6" 3¾" carb sh;
3" (bkn) coal; ¼" dk gy sh; ¾" lt. gy sh;
1¾ ch sh w clens; 2¾" coal,
3¾" inf. coal w. ½" ch sh at 1¾"; 1" lt gy sh, dip 18°;
3⅜" coal, ⅜" med gy. sh.; 2¼" coal,
⅜" carb. sh,
6½" coal, dip 20°;
721'3¾" 2¾" (bkn) inf. coal;
3½" dk. gy. sh; 1½" coal, ¾" carb sh,
3" (p.b) coal;
4" dk gy sh;
722'7¾" 3¾" inf. coal;
Floor: coal measures,

N.S. 122

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled
A: 36·0		
S.G. 1·626		
W. ※		
Results on comp. of floats:		
M. 2·2		
VM. 27·0		
FC. 50·5		
A 20·5	85%	271/55
S. 0·23		
Joules/Gm. 25,770		
BTU/lb. 11,090		
S.G. 1·467		
A. 26·6		
S.G. 1·519		
W. ※		
Results on comp. of floats.		
M. 2·1		
VM. 29·0	100%	272/55
FC 52·3		
A. 16·8		
S. 0·25		
Joules/Gm. 27,490		
BTU/lb. 11,820		
S.G. 1·419		
A. 37·6		
S.G. 1·658		
W. ※		
Results on comp of floats	100%	273/55
M 2·1		
VM. 29·2		
FC 47·2		
A. 21·5		
S 0·29		
Joules/Gm. 25,410		
BTU/lb 10,930		
S.G 1·467		

Overall recovery 98·5%



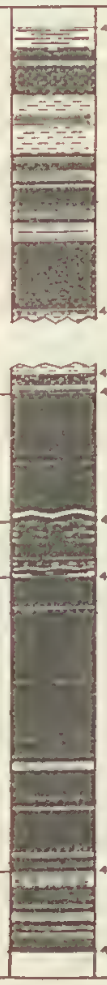
276'2" Roof: 5" dk gy sh. with sa. above.
2" inf. coal, 2" carb. sh;
1½" (p.b) coal; 3¼" carb. sh. ← inf coal bet. 1⅝"-2";
½" dk. gy. sh; 2¼" carb. sh. with few coal lam;
4" coal; 1½" inf. coal,
5" carb. sh w irreg. coal lam;
6" dk gy sh, few coal lenses,
2⅝ inf. coal, 2" dk gy. sh;
2" carb. sh.;
1'7" (partly bkn) coal with ¼" sh. at 6" & at 11", ¾" carb. sh. at 6¼",
281'7" 10" carb. sh. with few coal lam;
f. sa., silts. & sh.;
305'3¾" 3¾" carb sh with ⅛" coal at 1",
305'7" 9" (bkn. top 6") inf coal ← coal, 3",
3¼" carb. sh. ← inf. coal, 1",
1'0¾" coal, inf. top 1", (bkn. bottom 5");
1⅝" dk. gy. sh; 3½" (bkn) carb sh 50% coal 50%;
308'11¾" 1¼" (p.b) gy. sh; 2¾" carb. sh;
1" inf coal; 1¼" carb. sh; 1" inf coal,
3½" coal; ¾" carb sh; ¾" dk gy. sh;
4⅜" coal;
1⅜ carb. sh w coal lam; 2" coal,
1¼" inf. coal; 1" carb. sh;
2'0¾" coal, few sh. lenses btm. 4", dip 10°;
¼" carb. sh; ¼" dk gy. sh;
9" coal,
1" med gy sh;
5" (part. bkn) coal; 1" dk gy sh;
11½" coal w sh partings at 3" & 10½"
314'10½" 1" dk. gy. sh; 2" (bkn) coal;
2¼" carb. sh. w few l gy sh. & coal lam;
¾" inf. coal, 4¾" (p.b) coal w ¼" l gy sh. nr. top;
1¼" dk gy. sh;
7½" coal, inf at top & btm,
2" dk gy sh;
9" coal, inf. from 2"-4½", sh. lam. in btm 4",
317'7¾" 1½" bluey, 1¼" coal,
1½" fn. sh; 1½" coal; 3⅜" dk gy sh;
1" coal; 1" carb. sh; 1¾" inf coal,
318'7¼" 1" (broken) coal & dk gy. sh.;
Floor: shale.

N.S. 123

NOTE
※ For washability tests see appendix.

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled
M. 2·2		
VM. 29·4		
F.C. 48·4		
A. 19·0	94%	276/56
S. 0·27		
Joules/Gm 25,950		
BTU/lb 11,160		
S.G 1·445		
A. 38·3		
S.G. 1·843		
W. ※		
Results on comp of floats:		
M. 2·0		
VM 24·8	93%	277/56
F.C 48·0		
A. 25·2		
S 0·32		
Joules/Gm. 23,970		
BTU/lb 10,250		
S G 1·805		
A. 25·7		
S.G. 1·820		
W. ※		
Results on comp of floats.		
M 2·2		
VM. 28·3		
F.C. 48·4		
A. 20·1	100%	278/56
S. 0·29		
Joules/Gm. 25,960		
BTU/lb. 11,160		
S.G. 1·458		

Overall recovery 97·8%



475'9¼" Roof: shale
6½" interbd carb sh, dk gy sh & coal (bds ¼-½)
3" coal; 1½" med gy. sh;
8½" inf. coal with calcite lacing;
5½" dk. ← med. gy. sh,
3¼" carb sh. with ½" coal at 1¼";
8½" dk. gy. sh;
1" coal; ¼" lt gy sh; ½" coal, ½" lt gy sh, 2¾" coal w carb sh lenses, 3¼" carb sh → dk gy. sh in places, ¾" (pb) coal, ⅜" blk sh; 4½ coal → inf. coal, 1¼ inf. coal; 1" carb. sh. w. ¼" coal at base; 2½" (bkn) carb. sh; 1" coal,
5½" carb sh. & dk gy sh.;
1'7½" inf. coal, Dip 22°-25°;
482'7¾" 1" carb. sh;
sh. w. coal lam. at btm.;
485'9¾" 2" inf coal, 1¼" dk gy sh. w. few coal lents;
485'9¾" 1" carb. sh;
1'3¾" coal, slightly inf. between 9¾" & 1'1½", dip 24°;
2½" bluey; 2" coal; ½" med gy. sh;
1'0¾" (partly broken) coal,
488'10" 2" (broken) coal;
3¾" shaley coal; 3" carb sh. & inf. coal;
¼" dk. gy. sh; 4" coal;
490'2¾" ⅜" blk sh, 1" coal w ¼" dk gy sh. lenses, ⅜" dk gy sh, ¾" (pb) coal, 1¾" coaly sh;
7" coal w lt gy sh partings at 4" & 6",
1⅝" bluey, ¾" lt. gy sh (coal ptg in mid),
1½" bluey → to inf. coal, dip 23°;
1'7¼" coal w numerous sh partings;
½" lt-med gy sh;
1'4" coal,
½" lt gy sh; 4" coal,
1" carb. sh ← dk gy sh; 1" coal; 2½" m. gy sh;
10½" coal w ¼" m gy. sh. at 4½"; ¼" carb sh. at 7½";
⅜" med gy sh;
10¾" coal ← inf. coal btm. 1", dip 21°;
1½" carb. sh.; 1½" coal;
497'2¾" ⅜" bluey, ¼" dk gy sh; 1½" coal,
4½" carb sh. ← dk gy sh; 2½" coal w ¼ dk gy sh, at 1"; ¼" dk gy sh; ⅜" carb sh; 1¼" coal; ½ med gy. sh.; 1½ coal; 2¾" carb sh. w coal lenses,
1¼" (pb) coal, 1" dk gy sh; ⅜" coal; ⅜" med gy sh (brownish); 1" carb. sh. w coal lenses;
499'1¾" 3½" (p. bkn) coal;
Floor: shale.

N.S. 153

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled
A. 33·5		
S.G. 1·63		
W. ※		
Results on comp of floats:		
M. 2·8		
VM 30·3	100%	2/57
F.C. 48·4		
A. 18·5		
S 0·83		
Joules/Gm 26,490		
BTU/lb 11,590		
S.G. 1·44		
A. 42·3		
S.G. 1·69		
W. ※		
Results on comp. of floats:		
M. 3·0		
VM 28·9	100%	4/57
FC 45·0		
A. 23·1		
S 0·28		
Joules/Gm 24,210		
BTU/lb. 10,420		
S.G 1·49		

Overall recovery 100%

201'10¾" Roof: sh. with few coal bands;
9" interbd. coal, carb sh. & dk gy sh,
1½" lt gy sh, dip 7°; 1½" coal,
1" lt gy. sh.; 2" coal; 1½ carb sh.;
1½" coal; 1½" dk gy sh.;
1½" inf. coal; 2" blk sh; 2" coal;
6½" carb. sh. & inf. coal bands;
3½" coal; 1" carb. sh;
7" coal - some inf. coal,
8½" alt. bands coal, carb sh. & dk gy sh;
6½" coal;
¼" fn. sh; 3¼" coal; 1" black sh;
2½" inf coal; 2½" coal;
4" carb. sh. w. $FeCO_3$ gr. in top 1½" & w coal lam, ⅜ lent gy sh, 1½" dk gy sh; 1¼" inf. coal; 1" med gy. sh.; ½" inf. coal;
206'3" sh with few coal lam at top;
213'1¾" 1'4¾" irreg. interbd inf. coal & carb sh. with 1" lens. med. gy sh. 12" from top,
214'6" 5" coal,
⅜" lt gy. sh;
10½" coal, few sh lam,
1" lt. gy. sh.; 2½" carb sh.; 1¼" coal,
¼" lent l gy sh; 1" cb sh; 1" l gy sh, 1½" carb sh ← inf. c
1" coal, ¾" bluey, 2½" coal; ¼" lt gy sh;
1¼" coal ← cb sh, 1" m gy sh, ¾" cb sh, ¼" l gy sh,
5½" (p bkn) coal, 1" inf coal,
2½" bluey;
4½" coal;
1½" carb. sh ← inf coal, 2" (p b) coal,
½" fn. sh; 1¼" (p b) coal, 2" boulder,
6¾" coal w few $FeCO_3$ grains,
6" inf coal → carb. sh in places,
6" coal;
½" lt gy sh, 1" inf coal,
8¼" coal,
1¼" lt gy. sh;
4" coal; ¾" med gy sh; 1½" coal,
4¾" coal w. sh lent. in middle; ¾" med gy sh,
2" coal w. some $FeCO_3$ gr; 1" inf. coal,
7½" coal,
1" boulder, 1½" carb. sh. w. coal lents & $FeCO_3$ nod; 2¼" coal, 2¾" inf. coal;
225'11½" 1" coal; 2" med.-dk. gy. sh. w coal lents,
11" coal ← inf. coal in places w. ¼" sh. 7¼" fr. top; ⅜" fn - med gy. sh; 1½" coal (bkn. in btm. ¼; 2¼" med. gy. sh;
225'11½" 6" coal,
Floor: sh. & coal bands.

FIG. 4b

P.D.T.S. No.4 MINE AREA — NEW HOPE

DIAGRAMS OF LAGOON SEAM — DETAILS OF CORE RECOVERY AND ANALYSIS

N.S. 118

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	Seam Section	Description
				Roof: blk. sh. — carb. sh.
			924'5½"	2½"(p.b.) inf coal — coal; 1" inf. coal, ½" dk gy. sh; 1⅛" coal; 1" carb. sh.; 1¾" dk gy. sh; 4" coal (sh. lens at 1¾"), 1½" dk gy. sh; 2¾"(bkn) coal w inf. bands; 1½" dk gy. sh; ½ carb. sh;
				1'4¾" (partly bkn) coal with bluey band from 2½"-3½" from top
			927'6¾"	1" inf. coal,
				4'0" med. & dk. gy. sh. with few carb. sh. bands in top 1'6";
A. 29·6 S.G. 1·662 W. ※ Results on comp. of floats: M. 2·0 VM. 29·4 FC. 50·0 A. 18·6 S. 0·27 Joules/Gm. 28,560 B.T.U./lb. 11,420 S.G. 1·447	98·2%	262/55	931'6⅝" 931'11½"	2" inf coal; 2¾" dk. gy. & blk. sh;
				17½" (broken) coal & bluey (60%-40% aprx);
				2" bluey — coal in btm. ½"; 1½" l-med. gy. sh; 1'1½" (bkn. 8¾"-1'1½") coal — bluey in places; 1"(p bkn) carb. sh;
				3½" coal; 2" coaly sh.; 1" dk gy. sh.; 1" inf. coal; 7¼" coal w ¼" m-dk gy. sh. 3"
			936'4½"	fr. top; 1" m gy. sh. (lentic), 3¼"(p bkn) coal w ⅛" sh. 1" fr. btm.; ⅝"(p.b.) m. gy. sh.; 5¼" coal — inf. coal at btm; 1½" carb. sh. w. br. sh parting at top;
A. 31·2 S.G. 1·568 W. ※ Results on comp of floats: M. 1·8 VM 30·1 FC. 51·3 A. 16·8 S. 0·23 Joules/Gm 27,870 B.T.U./lb 11,860 S.G. 1·427	99·4%	263/55		1'3¾" coal, few sh. lam.;
				½" med gy. sh, 6½" coal, 3½" bluey,
				9" coal,
				¾" l gy. sh; 6¾" coal, inf in top 1"; 1¼" dk gy. sh; 2½" inf. coal; ⅝" lens m g sh, ¾" coal; ¾" l.-med gy. sh;
				6⅝" coal w. sh. lents. fr. 3⅜"-5¾" fr. top; 1" d gy sh; 1⅛"(p.b) coal; ¾" l gy. sh; 8¾" coal (p bkn. btm. 1½");
				¾" l gy sh;
A. 45·3 S.G. 1·737 W. ※ Results on comp of floats: M. 2·0 VM. 30·2 FC. 48·1 A. 18·7 S. 0·26 Joules/Gm. 26,550 B.T.U./lb. 11,420 S.G. 1·443	100%	264/55	943'3¾"	5¾" coal;
				¾" med. — blk. sh;
				9⅛" coal inf. in top 3" in places;
			944'8¾"	⅛" l. gy. sh; 3½" coal,
				5½" dk gy. sh slickensided;
				3½" inf. coal;
				4½" blk sh;
				3' carb sh w coal lents & m g sh pkg at 1"; ½" blk sh, ¼" coal (lent), 2¾" lod coal g sh; 5" coal w ¼" bluey at top; 3¾" med gy sh;
				¼" coal, ½" blk sh;
				1" shaley coal, 1" coal, 1½" coal, 2½" blk. sh;
				1" coal; ½" dk gy. sh;
				6½" coal w num. m g sh lam & carb sh bds, ½" l gy sh; ½" blk sh.; ¼" carb sh; 1⅛" boulder; 3" carb sh w coal lents; ¾" coal, 1" m gy sh; 2" carb. sh, 1½" l. to med gy. sh; 1½" coal;
			949'10"	6¼" carb sh.
				Floor: shale.

Overall recovery 99·7%

N.S. 120

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	Seam Section	Description
				Roof: shale
			310'6"	4" shaley coal, 1½" dk gy. sh; 1" coal, 2¼" lt gy. sh.; 1¾" coal, 2" lt. gy. sh; ⅜" carb sh; 1½"(bkn) coal; 7½" dk gy. sh;
				4½" carb. sh, coal lents. in top 1½"; 2½" dk gy. sh.; 3" f'b'd coal & carb sh lam; ⅛" med gy slts; 5" carb. & dk gy sh;
				1½" coal w calcite veinlets; 2¾" carb sh w d gy. sh. lenses; 1¾" coal; 4¾" carb sh w ¼" coal at 2¼, ⅝" coal at 3", 3¾" bluey & coal bands; 1¾" carb sh w coal lents. in btm. 1";
				11" coal with carb. & dk gy. sh. lents;
				1' dk gy sh;
				7½" irreg. interb'd coal & dk gy sh bands (up to 1" thick); 5" coal w. few carb. sh lam;
				2" bluey; 3½" coal; 1½" carb. sh.;
			318'1½"	4¾"(bkn. in top 1¼") coal;
				mod. & dk gy. sh;
A. 44·8 S.G. 1·764 W. ※ Results on comp. of floats: M. 1·9 VM. 30·3 FC. 42·2 A. 25·6 S. 0·27 Joules/Gm 23,150 B.T.U./lb. 9,960 S.G. 1·530	100%	265/55	321'10½"	2" coal w ½" lens. dk gy. sh.; ¾"(b in btm 1") coal w. few carb. sh. lam;
			322'4"	1" blk. sh; ¾" coal, 1½" carb. sh; 6½" coal w few med. gy. sh. lam. top 3";
				2'2" (broken top 1") coal with ¾" carb sh. at 7¼";
A. 30·0 S.G. 1·553 W. ※ Results on comp. of floats: M. 1·9 VM. 29·3 FC. 50·4 A. 18·4 S. 0·28 Joules/Gm. 28,790 B.T.U./lb. 11,630 S.G. 1·443	100%	266/55		1'6" coal w. carb. sh. lam; 1" crushed & f'ltd. carb. sh.; 1⅛" l.-m gy. sh.; 2⅝" inf. coal;
			326'2⅝"	½" l gy sh; 1⅛" coal — bluey; 2⅝" interbd. carb. & dk gy sh;
				1'3½" coal with 1" carb sh. at 4½";
				2¾" interbd carb. sh. & med. gy. slts. with few coal lents.; ½" bluey;
				1'10" coal with ½" carb. sh. at 9";
				½" dk gy. sh; 1" bluey;
A. 29·6 S.G. 1·548 W ※ Results on comp of floats: M 2·0 VM 29·6 FC. 51·6 A. 16·8 S 0·22 Joules/Gm. 27,640 B.T.U./lb. 11,890 S.G. 1·422	100%	267/55		1'8" coal with ½" dk gy sh. at 7¼";
				1½" dk gy sh., 11¾" coal;
				1" bluey; 1¾" coal; ¾" dk gy. sh.;
				11¾" coal,
				¾" carb sh.; ¾" l. gy. sh; 5" coal; ½" d gy. sh; 2" coal;
			334'6¾"	2¾" blk sh — m gy sh, 2" inf coal, 1½" coal, 2¾"(bkn) inf coal, 2¾" carb. sh. — inf coal, 2"(p bkn) coal; 1⅛" med gy sh; 2⅛"(bkn) coal;
				4" dk gy. sh; 1½"(part. bkn) coal;
			336'10¾"	2½" interb'd. carb, dk gy. sh & coal; 1¼" coal.
				Floor: Coal measures

Overall recovery 99·5%

※ For washability Tests see appendix

N.S. 124

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	Seam Section	Description
				Roof: med-dk gy sh;
			1107'4"	6" dk gy sh with thin carb sh bands, 2" inf coal, 2½"(b) inf coal, 1" carb sh, 3"(bkn) inf coal; 7½" dk gy sh; ¾" inf coal, 1" carb. sh.; 8" coal; ½" dk gy. sh.; 6" coal; 1" carb. sh. w few coal lam; 6½" coal — inf coal in btm. 1½"; 1¾" carb sh;
			1111'6"	3¼" carb sh. w irreg. coal lenses, calcite lacing throughout;
				sh with thin sa. & slts.;
A. 31·8 S.G. 1·567 W. ※ Results on comp. of floats: M. 1·9 VM. 29·2 FC. 50·8 A. 18·1 S. 0·25 Joules/Gm. 27,080 B.T.U./lb. 11,650 S.G. 1·430	100%	386/55	1130'1¾"	4½" carb. sh;
			1130'6¾"	10½" (part bkn) bluey & inf. coal with 20% coal;
				11½" coal;
				1'0" (part broken) coal;
				1" sheared fawn sh; 6" (part. broken) coal;
			1134'1½"	½" dk gy sh. w coal lents; ½" lt gy. sh; 4½" interbanded bluey & coal; ¼" m gy sh; 3½ coal (⅛" lens. m gy sh at 2½, ⅝" m gy. sh, ¾" bluey; 2" coal w carb. sh. & dk gy sh lam, 4"(bkn. 1⅛"-3") coal;
				4½" carb. sh. w. coal lents. & lam;
				8½" coal (inf. in parts),
				10" coal;
A. 28·8 S.G. 1·541 W. ※ Results on comp. of floats: M 1·8 VM. 29·2 FC. 50·5 A. 18·5 S. 0·28 Joules/Gm 28,700 B.T.U./lb 11,590 S.G. 1·442	100%	387/55		1" med gy-br sh, ⅝" carb sh; 1"(b) coal (sooty bdm ⅜"), ¾" friable cb sh; ½" coal; ⅛" irreg bd bluey & carb sh; 5" coal, 1" carb. sh; 1½" coal; 1" inf. coal; 2¼"(b) coal — bluey; 1¾" m gy sh, ¼" carb sh; 3" coal;
				1'3" irreg. interb'd coal — inf. coal with sh. bands at 0-¼", 5"-5½", 7-7½" & penny bands in btm.;
				3¼" (bkn in top 3") coal, 1" dk gy sh, ½" inf coal; 2¾" coal (fn sh ⅝" lens at btm.);
			1141'1½"	2" inf coal, 1" coal, 2" carb. sh" (fn sh lens ¼" in mid) 2¼" d gy sh, 1"(p.b) coal, ¾" cb sh, 1" coal, 1½" carb. sh, ¾" boulder; 2½" inf coal (sooty ⅜"-1⅝" fr top); ¾" br. sh.; 2½"(bkn. ⅝"-2½") bluey & coal; 3¼" d gy sh; 4" coal 1" — inf coal,
				1'2¼" d. gy. & carb. sh. with coal lam. lenses & bands up to 1" wide thr'out;
				1" lt gy sh; 1" dk gy sh. with coal lents; 2¾" coal;
				8'(bkn) carb sh w few coal lam. 80% coal 10% gy sh. 10%; 3¼ carb sh. & blk. sh. lam;
				½" inf. coal; ½" carb. sh; ⅜" coal, ½" d gy sh; ½" fn sh.; 1¾ carb sh (w coal lam in top ½" & btm ¾"); 2¼" dk br. sh;
				10" coal (penny sh. bands at 2" & 5" from top.
			1147½"	
				Floor: shale

Overall recovery 99·7%

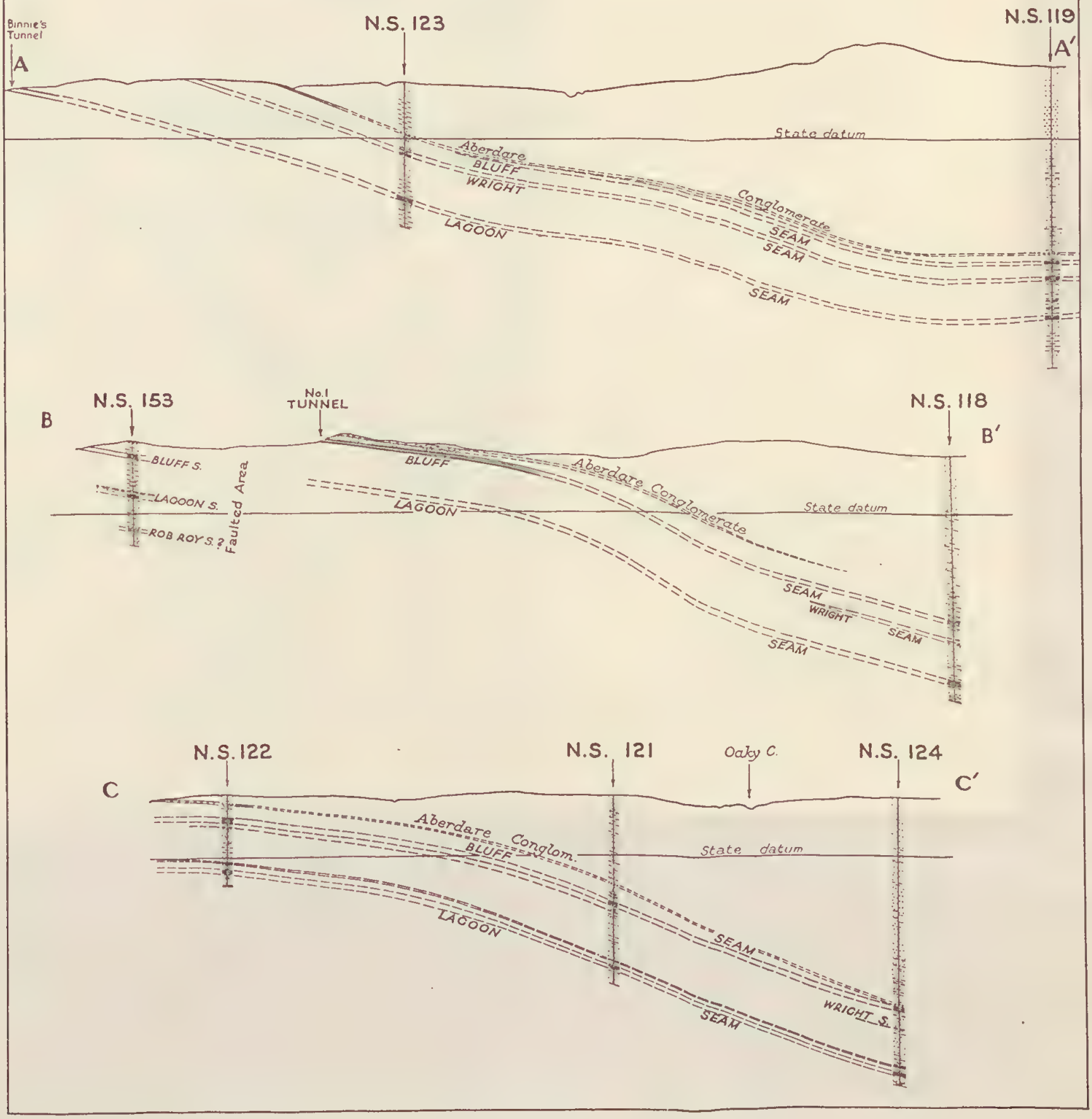
FIG. 5

P.D.T.S. No.4 MINE AREA · NEW HOPE · CROSS SECTIONS

SCALE :— HORIZONTAL AND VERTICAL

CHAINS 0 1 2 3 4 5 6 7 8 9 10 20

FEET 0 200 400 600 800 1000 1300



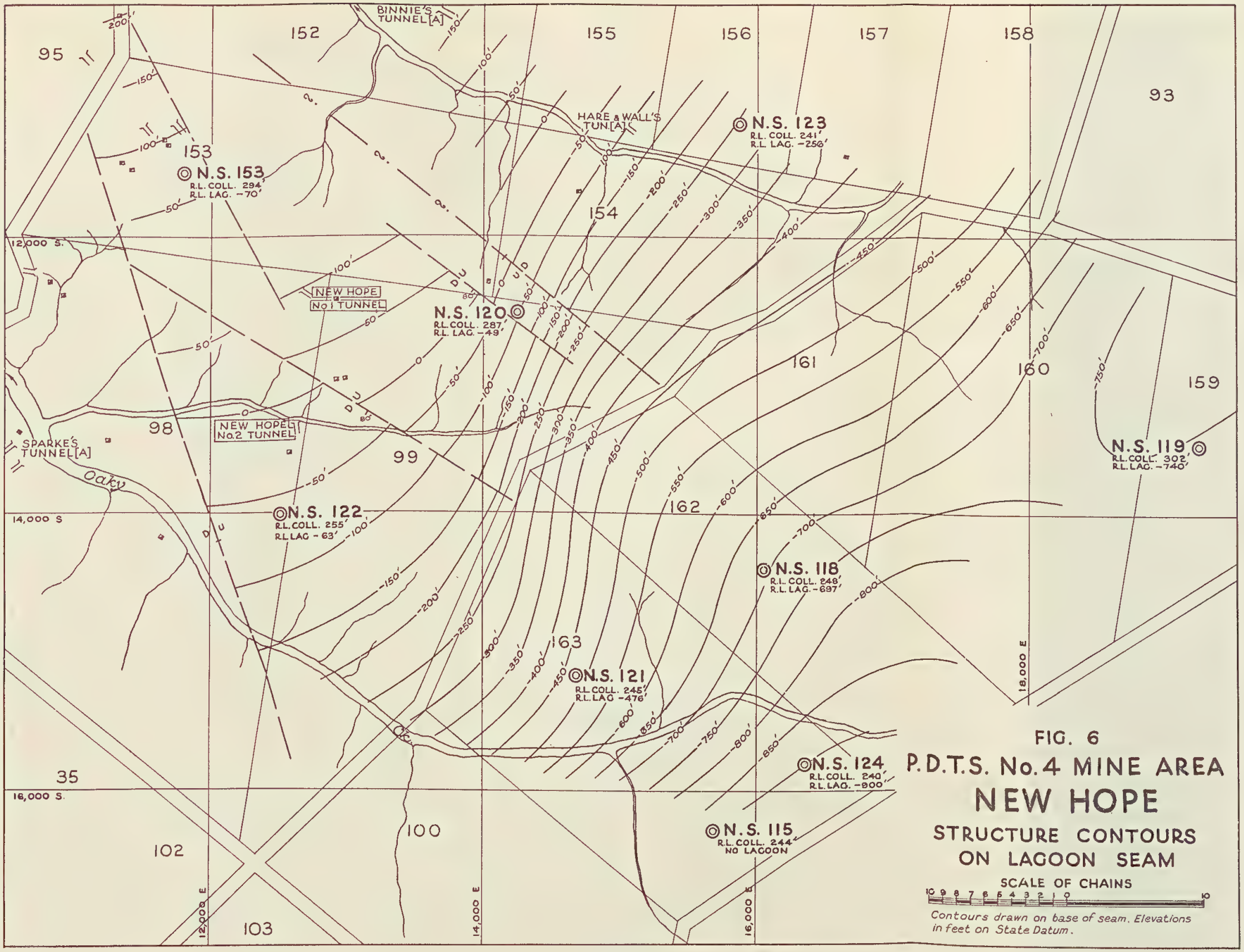


FIG. 6

P.D.T.S. No. 4 MINE AREA

NEW HOPE

STRUCTURE CONTOURS ON LAGOON SEAM

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10

Contours drawn on base of seam. Elevations in feet on State Datum.

QUEENSLAND
DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

PUBLICATION No. 290

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD

PART 11. P.D.T.S. No. 13 MINE AREA, NEW ABERDARE EAST

By B. W. HAWKINS, B.Sc., Geologist.

BRISBANE
By Authority: A. H. Tucker, Government Printer
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SUMMARY.

To further implement recommendations made by Powell Duffryn Technical Services, Ltd., drilling was commenced in October 1955 to prove reserves in the seam being worked in New Aberdare East No. 4 Colliery at Redbank.

Six boreholes, varying in depth from 329 ft. 6 in. to 775 ft. and aggregating 3,306 ft., were drilled in the western half of the area but, because of rapid deterioration of the coal seams easterly, the sites selected in the eastern part of the area were not drilled.

This report, accompanied by seven figures, describes the geology of the area, discusses the results of drilling and provides an assessment of coal reserves available.

Because of general deterioration of the coal seams to the east and south and because of changes in the lithology of the various formations, it is suggested that P.D.T.S. No. 13 Mine Area lies near the margin of the main basin of coal deposition.

Drilling has shown that, while the full succession of seams in the Blackstone "Stage" is recognisable in the extreme western part of the mine area, only the Rob Roy persists over the area drilled and reserves are confined to that seam.

The work has resulted in revision of seam nomenclature in the area and the seam worked until recently in New Aberdare East No. 4 Colliery as the Striped Bacon Seam is now considered to be the Rob Roy. The evidence on which revision is based is discussed.

Except in the north-western part, the structure of the area is complicated by folding and faulting. A domal structure elongated along a NNW axis has been mapped to the south of New Aberdare East No. 4 Colliery, and to the north of this the area is strongly folded on approximately NW-SE axes. Two major faults intersect the area and must be taken into account in appraising mining possibilities as must also a strike fault on which earlier mining in the Striped Bacon Seam ceased.

Total reserves in the Rob Roy Seam in the area of 117 acres with average workable thickness of 5 ft. 1 in. have been calculated at 1,100,000 tons, for which weighted ash values average 29·3 per cent. Availability of these reserves for economic mining is governed by faulting which divides the area into three sections. It is unlikely that 480,000 tons in the northern and eastern sections will be mined, but successful penetrations of strike faulting ahead of New Aberdare East No 4. Colliery dip would provide access to the south-western area of reserves amounting to 620,000 tons.

H. G. S. CRIBB,
Assistant Chief Government Geologist.

COAL RESOURCES, WEST MORETON (IPSWICH) COALFIELD.

PART 11. P.D.T.S. No. 13 MINE AREA, NEW ABERDARE EAST.

Introduction.—On completion of drilling in the New Hope area the Mines Department Failing 2,500 and Joy Sullivan 37 plants were moved to P.D.T.S. No. 13 Mine Area. This area, embracing New Aberdare East No. 4 Colliery, is situated from one to two miles south west of Redbank Railway Station, and covers the area known as the Verrall Estate. Drilling, which was designed to prove reserves in the Striped Bacon Seam, commenced on 14th October, 1955, and continued till 8th June, 1956, with a break from February to May due to inaccessibility of the last bore site.

Six boreholes numbered N.S. 128, N.S. 130-133 inclusive and N.S. 140 varied in depth from 329 ft. 6 in. (N.S. 140) to 775 ft. (N.S. 128) and aggregated 3,306 ft. drilled.

Boreholes were situated on, or near to P.D.T.S. sites but the programme envisaged in the original plan was curtailed because of deterioration of coal seams in an easterly direction.

Underground sampling of coal faces was carried out in New Aberdare East No. 4 Colliery, the only mine working in the area at the time of the drilling campaign. This pit closed down in April, 1956, prior to the drilling of N.S. 140.

Sections of coal seams recovered by diamond drilling were inspected by Engineer Members of the Queensland Coal Board before sampling.

The detailed geological mapping of the area is the combined work of D. C. Mengel, Assistant Geologist, and the writer.

The report is accompanied by the following plans and sections:—

Fig. 1. A plan showing bore sites, topography and surface geology.

Fig. 1a. A locality map.

Fig. 2. A plan showing bore sites, underground workings, P.D.T.S. Mine Area, and approximate area in which reserves have been calculated.

Fig. 3. A plan showing structure contours on the Rob Roy Seam.

Fig. 4. Two cross-sections.

Fig. 5. Generalised bore sections.

Figs. 6 and 7. Detailed sections of seams from boreholes and from mine workings showing recoveries and analytical data.

Geology.—The general deterioration of the coal seams to the east and south in No. 13 Mine Area, as shown in bore cores and mine workings, suggest that this area was on, or towards the edge of the main basin of coal deposition in Middle Triassic time. Freshwater sediments with coal seams spread far east of here, but the typical succession of the Bundamba mining district cannot be recognised with certainty even over the whole of P.D.T.S. No. 13 Mine Area.

This lack of certainty in correlation leads to difficulties in determining the horizons of the various stratigraphic units, a position which is made more insecure by lack of coal crops over the eastern half of the area and by the fact that the lithology of the various formations has changed from types that have become recognised as typical for particular formations.

Bundamba Sandstone.—The variation in lithology mentioned above is first demonstrated at the base of the Bundamba Sandstone which cannot be defined with any accuracy because of the absence of Aberdare Conglomerate and Aberdare Seam at outcrop. Some indications of both are found in N.S. 128 and N.S. 130 but only approximate horizons can be determined.

The lower part of the Bundamba Sandstone is represented by approximately 300 ft. of fine to coarse grained sandstone with numerous thin beds of shale and siltstone regularly disposed throughout the sequence.

The Aberdare Conglomerate has not been located from boreholes or at outcrop. Thin carbonaceous shale horizons at 302 ft. in N.S. 128, and at 352 ft. in N.S. 130 may be equivalent to the Aberdare Seam, but the only evidence to support this possibility is the occurence of a pinkish, light grey shale impregnated with grains and needle-like crystals of iron carbonate just below the carbonaceous shale. The close association of such a "pink" shale and the Aberdare Seam has been noted previously (2).

Medium and coarse grained sandstone outcrops, which cover some of the southern and eastern portions of the Verrall Estate, probably represent the basal part of the Bundamba Sandstone.

Blackstone "Stage".—In the absence of Aberdare Conglomerate the top of the Blackstone "Stage" cannot be located exactly. In the western part of the area outcrops of fine to medium grained sandstone with some siltstone and shale—a lithology which is

typical of the basal section of the Bundamba Sandstone, extend down towards the position of the Four Feet Seam outcrop. In the basal section of this sequence a seam 3 ft. thick, which outcrops in a railway cutting at the SW corner of portion 218, Goodna, probably represents the Aberdare Seam. This outcrop can be correlated with one of two distinct carbonaceous horizons which have been prospected above the Four Feet Seam east of the railway. The lower of the two seams is considered to be the equivalent of the Bluff Seam.

In all six seams were penetrated by boreholes in the Blackstone "Stage". The "Stage" varies in thickness from approximately 360 ft. in N.S. 128 to approximately 445 ft. in N.S. 132.

In determining these thicknesses the position of the top of the Blackstone "Stage" has been assumed, while the bottom has been taken as the pavement of the seam worked in New Aberdare East No. 4 Colliery as the "Striped Bacon" Seam but now considered to be the Rob Roy Seam.

Cooneana "Stage".—In most of the mine areas drilled in the Bundamba district the Cooneana "Stage", which underlies the pavement of the Rob Roy Seam, is represented by 20 ft. to 30 ft. of shale and siltstone overlying a characteristic coarse, often pebbly sandstone. In No. 13 Mine Area the upper 200 ft. of the Cooneana "Stage" is largely shale and siltstone with subordinate amounts of fine grained sandstone (see N.S. 128, N.S. 133, fig. 5).

Two coal seams were met in the Cooneana "Stage". The upper one was penetrated in two of the four bores drilled to sufficient depth to reach it, at an average interval of 30 ft. below the Rob Roy Seam, while the lower seam was located 350 ft. from the top of the "stage" in N.S. 133.

The Coal Seams.—Boring in No. 13 Mine Area disclosed eight coal seams of which only one, the Rob Roy, is known to persist over the area.

The seams in descending order are as follows:—

Aberdare Seam.
Bluff Seam.
Four Feet Seam.
Bergin Seam.
Striped Bacon Seam.
Rob Roy Seam.
Two unnamed seams in Cooneana "Stage."

Seam Nomenclature.—Although the seam mined in New Aberdare East No. 4 Colliery is known locally as the "Striped Bacon" Seam evidence available from drillholes points to the worked seam being the Rob Roy.

The local seam nomenclature seems to derive from earlier misconceptions as to the identity of the Striped Bacon and Bergin Seams in the area. The result was that the seam which is now regarded by the writer as the Striped Bacon Seam was called the "Bergin" and accordingly the underlying Rob Roy Seam was named the "Striped Bacon."

The first indications of this confusion were noted in N.S. 128 when a thickness of 140 ft. was drilled below the pavement of the previously named "Striped Bacon" Seam without encountering the Rob Roy Seam. Subsequent drilling in the Whitwood-Rhondda areas demonstrated that the section of the Rob Roy Seam there was similar to the "Striped Bacon" Seam of the New Aberdare East area both in thickness and in the frequency of fawn shale bands throughout the seam. The Striped Bacon Seam in Whitwood area is not highly banded and the seam from roof to pavement is only 8 ft. to 10 ft. thick. It is separated from the Rob Roy Seam by 80 ft. of sediments.

The seam worked in New Aberdare East No. 4 Colliery was penetrated in N.S. 128 between 614 ft. and 635 ft. An overlying thick coaly section from 504 ft. to 542 ft., with a workable section between 532 ft. 6 in. and 538 ft., corresponds to the "Bergin Seam" of New Aberdare East No. 3 Tunnel. Critical examination of the cores from N.S. 128 revealed that the section 504 ft. to 542 ft. is made up as follows:—

504 ft. to 510 ft. coaly section,
510 ft. to 516 ft. shale with a few coal bands,
516 ft. to 525 ft. 6 in. coaly section,
525 ft. 6 in. to 531 ft. shale,
531 ft. to 542 ft. coaly section, with sampled section from 532 ft. 6 in. to 538 ft. carrying 29.4 per cent. ash.

The section 504 ft. to 525 ft. 6 in. probably represents the top and bottom sections of the Bergin Seam separated by a shale band at 510 ft. The coaly section from 531 ft. to 542 ft. then represents the Striped Bacon Seam and the interval to the Rob Roy Seam is 72 ft.

The confusion in the identification of the Bergin and Striped Bacon Seams in the Whitwood-New Aberdare East area is further exemplified in Whitwood No. 4 Shaft. Workings to the south of the shaft were reported to be on the "Bergin" Seam but borehole N.S. 137 (part of the Whitwood programme) showed that this seam was in fact the Striped Bacon Seam.

Boring across the southern parts of the Whitwood and New Aberade East areas has shown that the interval between the Bergin and Striped Bacon Seams decreased easterly and that the Bergin Seam is unworkable east of the southern workings from Whitwood No. 3 Shaft. Under such conditions it is to be expected that confusion in naming would have arisen in the past.

In the northern part of the New Aberdare East area the coal section equivalent to the Bergin-Striped Bacon Seams in the south is much thinner and is unworkable throughout. Only one split is present and it cannot be determined whether the section represents both seams or the Bergin Seam alone.

DESCRIPTIONS OF THE SEAMS.

Aberdare Seam.—This name is here applied to a thin carbonaceous shale horizon which occurred in N.S. 128 and N.S. 130 at from 10 ft. to 20 ft. above the pink shale bed which often characterises the shales in close proximity to the Aberdare Seam horizon in other parts of the field.

The outcrop of the seam has been traced for approximately 15 chains to the ENE from a cutting in the Redbank-Bundamba railway loopline SW of portion 218, Goodna.

Bluff Seam.—A 10 ft. thick coal and shale section in N.S. 128, which deteriorates to a 4 ft. 6 in. thick section in N.S. 130, occurs 60 ft. below the Aberdare Seam. These sections, and a carbonaceous shale bed 4 ft. thick at 257 ft. in N.S. 132, probably represent the Bluff Seam.

The outcrop of what is probably the Bluff Seam has been located seven chains SE from New Aberdare East No. 3 Tunnel.

Four Feet Seam.—This seam is known in the western part of the mine area only. Tunnels driven on the seam showed that it was unworkable (1, p.99), a fact which has been verified by the present drilling. The Four Feet Seam lies 55 ft. below the Bluff Seam in N.S. 128 and N.S. 130. The thickest seam section was penetrated in N.S. 128 where 13 ft. of coal and shale was drilled between 404 ft. and 417 ft. The "double white" marker band, characteristic of the Four Feet Seam, was not recognised, but 2 ft. 7 in. of coal at 411 ft. 8 in. probably represents the main seam which elsewhere immediately underlies it.

Twenty-five chains east, in N.S. 130, the total seam thickness was reduced to 4 ft. of inferior coal and shale bands. The seam was not recognised in N.S. 132 which lies east of N.S. 130.

Borehole N.S. 131 in the northern part of the mine area showed the Four Feet Seam to be 7 ft. 2½ in. thick of which only 4 ft. 5 in. was coal. Again the "double white" marker band was not recognised. It is possible that one ft. of coaly shale at 65 ft. in N.S. 140 represents the seam in that borehole. The Four Feet Seam rarely outcrops as a recognisable coal seam in this area and it has usually been prospected by a stone adit driven on the anticipated seam horizon till coal was reached.

Bergin Seam.—The Bergin Seam was penetrated in four boreholes. It lies 95 ft. and 60 ft. below the Four Feet Seam in N.S. 128 and N.S. 131 respectively, but the interval is unknown in the other two bores. In no case was a workable section penetrated, the seam being represented by from 12 ft. to 25 ft. of coal and shale bands.

As discussed above, the writer considers that New Aberdare East No. 3 Tunnel worked the Striped Bacon Seam and not the Bergin. In the northern part of the mine area a number of tunnels have been driven on the Bergin Seam but in only one instance, viz. in Bennett's old tunnel (1, p.99), has any development been done on the seam. Whether the thick coal section which is known to be split at the outcrop is a composite of Bergin and Striped Bacon Seams or whether it is the Bergin Seam alone is a matter for conjecture. The only bore in this part of the area, N.S. 131, shows a section of coal and shale 22 ft. 6 in. thick which has been intruded by a sill in the bottom half of the section. At outcrop this borehole section is represented by two coal horizons approximately 20 ft. apart which have been prospected by a number of adits. Inspection of several of these adits revealed that the coal was inferior in both splits although in general the coal in the upper split was of superior quality to that in the lower. A sill forms the roof of the lower split in an adit 5½ chains SE of New Aberdare East No. 1 Tunnel. It is likely that the two coaly sections outcropping in this area are representative of the Bergin Seam while the Striped Bacon Seam has ceased to exist as a recognisable coal seam.

Striped Bacon Seam.—In the light of the above discussion the only definite penetration of the Striped Bacon Seam occurred in N.S. 128 between 531 ft. and 542 ft. A section 5 ft. 6 in. thick was sampled from 532 ft. 6 in. and carried 29·4 per cent. ash. No evidence of the Striped Bacon or Bergin Seams was seen in N.S. 130 and it is difficult to determine whether erosion or non-deposition is responsible for the absence of both seams in this borehole.

Rob Roy Seam.—This name is now applied to the seam worked in New Aberdare East No. 4 Colliery where it was known as the Striped Bacon Seam.

The Rob Roy Seam occurred in the six boreholes in the area at depths ranging from 110 ft. in N.S. 128 to 185 ft. in N.S. 140 below the Bergin Seam. A workable section was penetrated in each bore with the exceptions of N.S. 132 and N.S. 133. In N.S. 132 the seam was encountered in a brecciated fault zone with a resultant poor recovery of 45 per cent. Of the core recovered one third was shale, the broken coal evidently having been largely washed away in the drilling mud.

N.S. 133, in the NE corner of the mine area, revealed a seam section which had deteriorated markedly from that encountered in N.S. 131, some 25 chains to the WSW. The overall seam thickness of 18 ft. in this bore was less than the 25 ft. average.

The seam has been extensively worked from New Aberdare East No. 1 Tunnel where a section 5 ft. 3 in. thick was mined (1, p.100). The coal deteriorated going east, so the unworkable seam section encountered in N.S. 133 was not unexpected.

New Abedare East No. 4 Colliery, which closed in April, 1956, reached the Rob Roy Seam by means of a stone drive approximately 15 chains long. The dip on the seam averages 11 deg. to the south. The working height averages 5 ft. 2 in. while up to 8 ft. of coal and shale bands have been exposed above the roof.

Those bores which penetrated a workable section of the Rob Roy Seam showed that in general it retained many of its characteristics throughout the area, although the thickness of coal and shale bands underlying the workable section was variable, e.g., 8 ft. in N.S. 128 and 23 ft. in N.S. 140.

The upper portion of the seam consists of from 8 ft. to 10 ft. of shale and coal bands, with a relatively constant bottom section as follows:—

6 in. fawn shale.
2 in.–6 in. carbonaceous shale.
2 in. interbedded "plastic" light and dark grey shale.
1 ft.-1 ft. 6 in. coal, carbonaceous shale, and fawn shale bands.

Underlying this is the workable section which can be divided into "tops" and "dirty bottoms." The "tops" vary in thickness from 2 ft. 10 in. in N.S. 131 to 3 ft. 8½ in. in N.S. 140. In New Aberdare East No. 4 Colliery this section is 3 ft. thick including a "boulder" band, which varies in thickness from 0 in. to 1 ft. 0 in., occurring 2 ft. from the top. The "boulder" has an average thickness of 4 in.

The ash percentage of the "top" section from boreholes varies from 15·7 per cent. in N.S. 131 to 25·8 per cent. in N.S. 128 so that the "dirty bottoms" which carry ash values in the vicinity of 40 per cent. can be included in the mined section without increasing the overall ash content to 30 per cent.

The "bottoms" as sampled vary in thickness from 9½ in. (N.S. 130) to 3 ft. 7¼ in. (N.S. 121). In the mine workings the "bottoms" made up mainly of "bluey" and inferior coal with shale bands. has an average thickness of 2 ft. 3 in.

Underlying the workable section is a succession of shale, carbonaceous shale and coal bands which attains a maximum thickness of 23 ft. in N.S. 140. This section, which is from 8 ft. to 13 ft. thick in most bores, is not present in N.S. 133.

Structural Geology.

Folding.—The north-western section of the mine area, which has not been noticeably affected by folding, has a regional strike slightly north of east.

The dip is to the south at up to 25 deg. between New Aberdare East No. 1 Tunnel and N.S. 131 but at an average of only 11 deg. in New Aberdare East No. 4 Colliery main dip. The steep dips in the northern section are due to this block having been down faulted and tilted.

South of New Aberdare East No. 4 Colliery area a well-defined domal structure has been mapped. The dome is elongated along a NNW axis and has flanks which dip at from 30 deg. to 40 deg. to the west and 20 deg. to the east. The pitch to the SSE is of the order of 10 deg. but no measurement of the pitch to the NNW could be obtained from outcrops.

To the east of this dome, but south of N.S. 130 and N.S. 132, a tightly folded asymmetrical syncline pitches to the SE. North-east of this syncline an open anticlinal structure has been mapped over the whole of the eastern part of the area. The axis of this fold strikes approximately N-S with apparent flattening in the southerly pitch of 10 deg. in the vicinity of N.S. 140 and a subsequent steepening towards N.S. 132. This variation in axial pitch is accompanied by a swing towards the SE in the strike of the fold axis.

Faulting.—The area is affected by two major faults. The first, a normal fault located in mine workings and by surface mapping, strikes WNW and dips at 45 deg. to NNE. Between N.S. 131 and the upper levels of New Aberdare East No. 4 Colliery the downthrow is approximately 250 ft. To the WNW the calculated throw decreases to 100 ft.

The second fault is another normal fault which strikes N-S to a point six chains east of N.S. 131 from which it swings to the SSE where it can be traced on the surface to a point midway between N.S. 130 and N.S. 132. South-east of this point a vesicular basic dyke, mapped over a short distance, apparently has intruded a fissure parallel to the main fault. The fault dips at from 60 deg. to 70 deg. to the west.

The displacement is not known with any degree of accuracy but indications from information available suggest a throw of at least 100 ft. along most of its length.

The first fault cannot be traced east of the second fault and appears to have been displaced by it.

A fault reported at the dip face in New Aberdare East No. 3 Tunnel is not known at the surface. This is apparently a strike fault since no dislocations are recorded along levels on either side of the dip face. The section line from N.S. 131 to N.S. 128, through New Aberdare East No. 4 Colliery workings, indicates a downthrow of 50 ft. to the south on this fault but insufficient detailed information is available to draw accurate conclusions.

Description of the Coal.—The average fixed carbon content of the coal from the Rob Roy Seam, calculated on a dry mineral-matter-free basis, is 64 per cent. The values from eleven samples range from 59·8 per cent. to 67·7 per cent., placing the coal in the high volatile bituminous group.

The moisture content showed little variation and, as elsewhere in the Ipswich Coalfield, averaged 2 per cent. Similarly the sulphur values, which ranged from 0·22 per cent. to 0·45 per cent. with an average of 0·3 per cent., showed little variation from figures obtained from other parts of the field.

The calorific value of coal carrying 25 per cent. ash is approximately 10,700 B.T.U.'s per lb.

Washability tests were carried out on two mine samples taken from New Aberdare East No. 4 Colliery. It was found that on washing these samples,

which originally carried 33·2 per cent. and 32·0 per cent. ash, in a medium of specific gravity 1·8 per cent. the percentage sinks were 20·0 and 22·2 respectively while the corresponding floats carried ash values of 22·5 per cent. and 19·6 per cent.

Coking tests were carried out on three borehole samples with inconclusive results. The Rob Roy Seam from N.S. 130 ("top" section only) was strongly coking with a swelling index of 5. In N.S. 131 the "top" section was medium coking and the swelling index was 4, while the "bottom" section was weakly coking with a swelling index of 1½.

Coal Reserves.—In calculating measured reserves an arbitrary limit of five chains beyond an outer borehole has been placed on the extent of workable coal. The maximum ash content of coal sections included is 30 per cent. The unavailability of coal due to faulting has been disregarded and no allowance has been made for loss in mining.

Measured reserves exist in the Rob Roy Seam only. The average seam thickness is 5 ft. 1 in. over an area of 117 acres for which the weighted ash values averaged 29·3 per cent. with a corresponding specific gravity of 1·538. Reserves have been calculated at 1,100,000 tons.

Future Prospects.—Ash values of two samples taken from New Aberdare East No. 4 Colliery were 33·2 per cent. and 32·0 per cent. respectively. These values were higher than values obtained from corresponding seam sections in boreholes N.S. 128, N.S. 130, N.S. 131, and N.S. 140.

In view of these analytical results it might appear that the closing of the mine in April, 1956, was premature, but the accessibility of the coal proved by boring and shown as measured reserves must be taken into account.

As demonstrated in the discussion on the geology and in fig. (1), the area is affected by severe faulting. Boreholes N.S. 131 and N.S. 140 are separated from N.S. 128 and N.S. 130 by faulting which for mining purposes divides the area into three sections.

Assessing the northerly and easterly prospects it is found that N.S. 131 is situated in a narrow corridor of virgin coal between New Aberdare East No. 1 Tunnel workings and the major faults to the south and east. N.S. 140 shows a workable section but to the rise of this bore N.S. 133 proved the seam to be unworkable near the crop, which fact is substantiated by the reported deterioration of the coal in the eastern levels of New Aberdare East No. 1 Tunnel. In effect, although measured reserves amounting to 480,000 tons approximately have been calculated for these areas, the disposition of the workable coal is such that it is not likely to be mined in the forseeable future.

The south-western area offers greater opportunity. Bores N.S. 128 and N.S. 130 show a workable seam thickness of 4 ft. 10½ in. carrying less than 30 per cent. ash. However New Aberdare East No. 4 Colliery, which was developing the coal in this area, closed down because a marketable product could not be produced profitably. In addition, the dip workings of New Aberdare East No. 3 Colliery in the overlying Striped Bacon Seam stopped on faulting in a position 2½ chains ahead of the Rob Roy Seam workings. Downthrow on this fault probably does not exceed 50 ft. to the south.

Slight improvement can be expected in the Rob Roy Seam towards N.S. 128 and N.S. 130, with a possible extension to the west. Faulting which would be encountered ahead of the present dip face in New Aberdare East No. 4 Colliery could prove to be a barrier to economic extraction of coal from the Rob Roy Seam but the real extent of such faulting is, for the present, mainly hypothetical. Measured reserves calculated for this portion of the mine area amount to approximately 620,000 tons.

Conclusion.—Measured reserves of coal in the Rob Roy Seam amounting to 1,100,000 tons have been proved in P.D.T.S. No. 13 Mine Area. The weighted ash content of this coal is 29·3 per cent. Borehole seam sections had slightly lower ash values than mine samples from New Aberdare East No. 4 Colliery.

The area over which reserves have been calculated is divided into three sections by two major faults. The northern and eastern sections together contain measured reserves amounting to approximately 480,000 tons which would prove costly to exploit.

The south-western section, which lies ahead of the recently abandoned New Aberdare East No. 4 Colliery, contains measured reserves amounting to approximately 620,000 tons. In this area strike faulting of unknown extent could prove to be a bar to economic extraction of the coal proved.

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(2) HAWKINS, B. W., 1957—"Coal Resources, West Moreton (Ipswich) Coalfield, Part 8. P.D.T.S. Nos. 9 and 10 Mine Area, Blackheath-Bonnie Dundee. Q'land Geol. Surv. Publication No. 288.

A. H. TUCKER, Government Printer, Brisbane.

FIG. 1

DEPARTMENT OF MINES, QUEENSLAND

GEOLOGICAL MAP

P.D.T.S No.13 Mine Area
NEW ABERDARE EAST
IPSWICH COALFIELD

Parish of Goodna · County of Stanley

Showing geology, topography & boreholes

To accompany report by B.W.Hawkins, B.Sc., Geologist

Survey by Ewan Cowley, Assistant Surveyor.

SCALE OF CHAINS

10 9 8 7 6 5 4 3 2 1 0 10 20

J.A.W. 23.5.67

SURVEY DATA

Elevations on State datum. Grid of 20 chain co-ordinates.
Meridian of grid is True North at origin, an arbitrary point being bolt in concrete block on road near angle in Eastern boundary of Sub 1, Por. 213, Parish of Ipswich.

EXPLANATION

Diamond drillhole ◎ N.S.115
Colliery NEW HOPE
Surface contour ~220~
Outcrop
Established bdy. position accurate
" " approx.
Inferred, probable or indefinite bdy.
Tertiary Sediments
Bundamba Sandstone

Adit
Colliery (abandoned) NEATH A
Coal seam at surface
Section line A—A'
Established fault position accurate
" " approx.
Inferred, probable or indefinite fault
Ipswich Coal Measures:
Blackstone Stage
Cooneana Stage

Shaft

NEW ABERDARE EAST MINE AREA FIG.1A

LOCALITY MAP

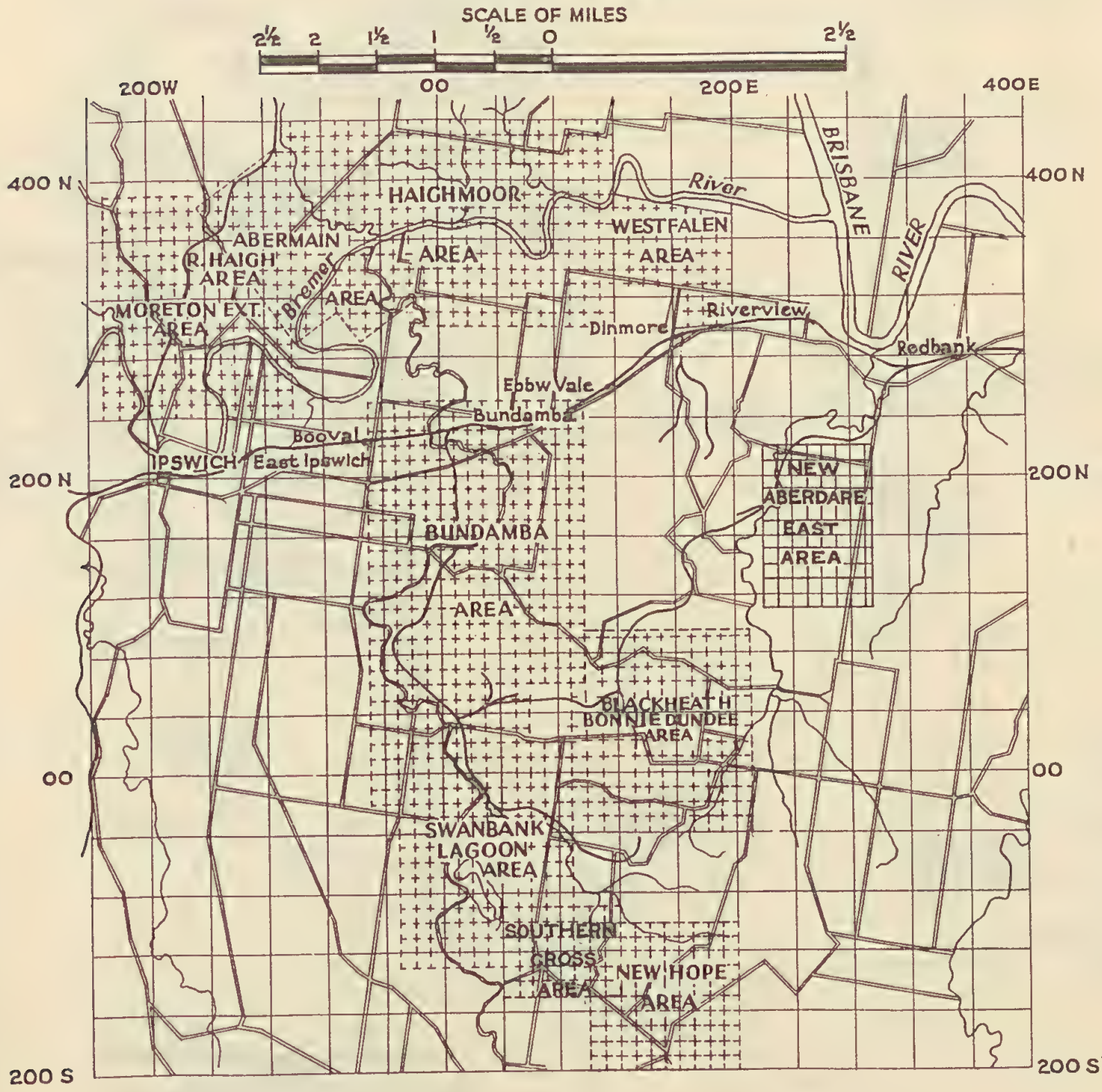


FIG. 2

P.D.T.S. No. 13 MINE AREA • NEW ABERDARE EAST
MINE WORKINGS AND BOUNDARY OF CALCULATED RESERVES

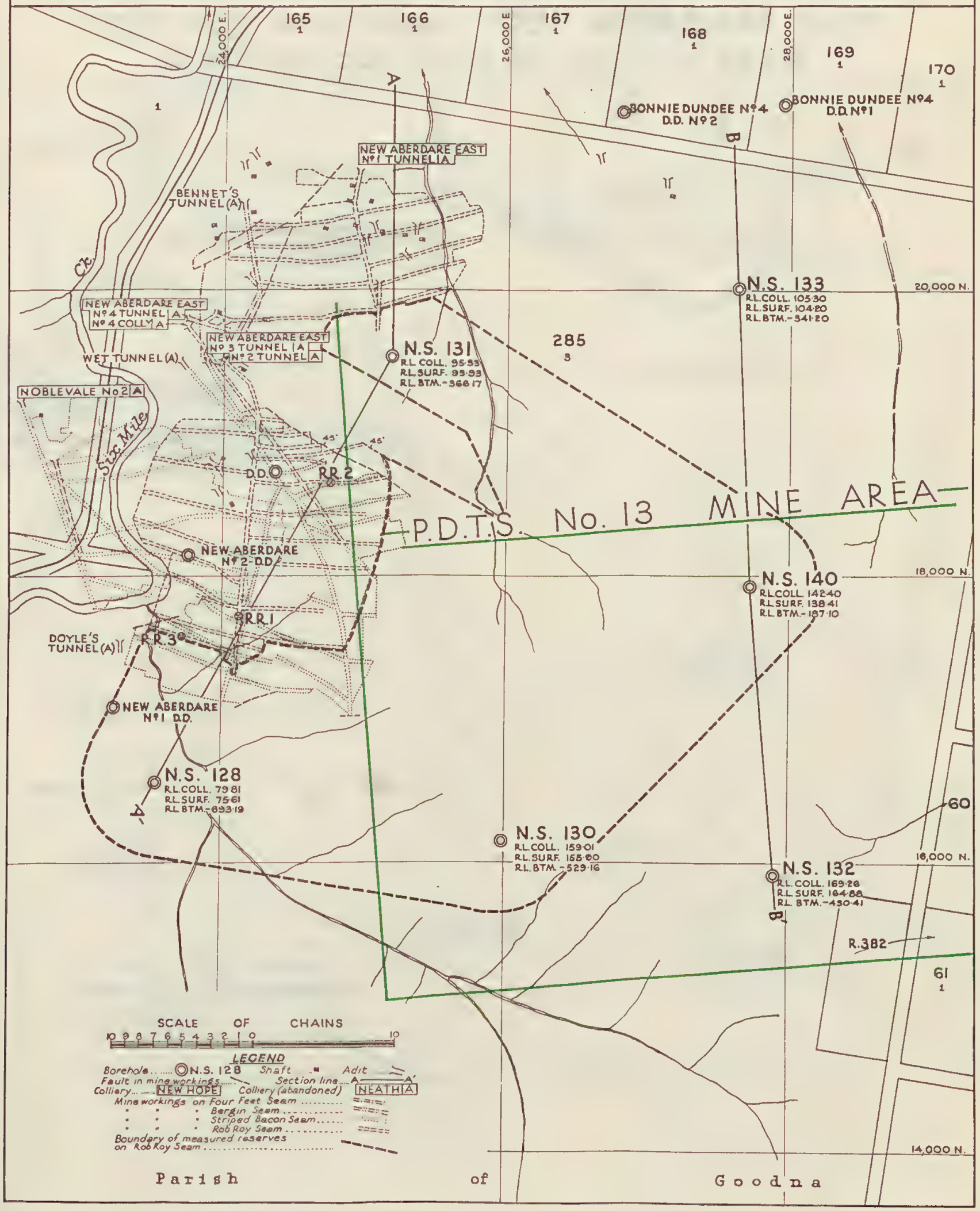
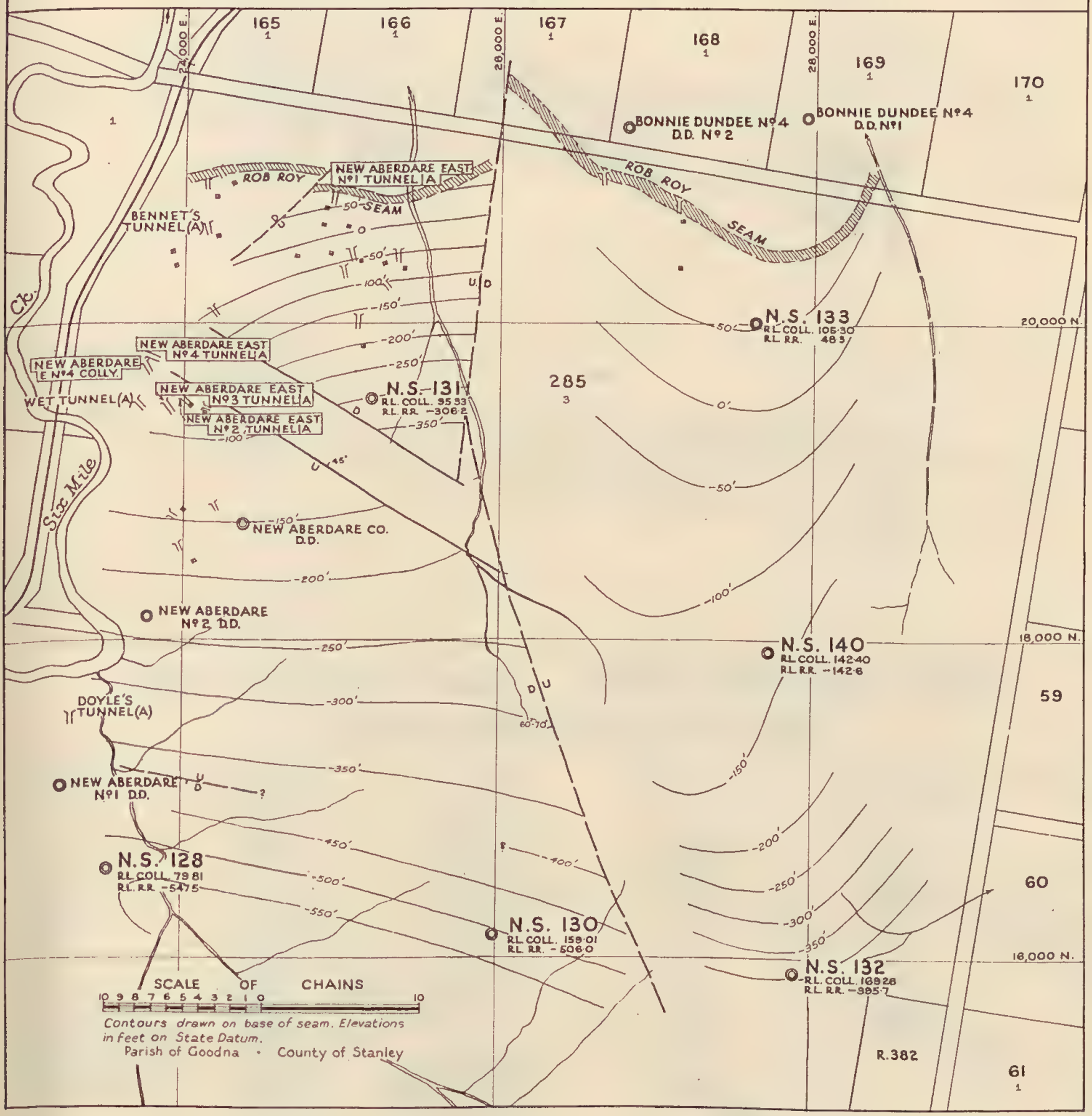


FIG. 3

P.D.T.S. No. 13 MINE AREA • NEW ABERDARE EAST
STRUCTURE CONTOURS ON ROB ROY SEAM



Contours drawn on base of seam. Elevations in feet on State Datum.

Parish of Goodna • County of Stanley

FIG. 4

P.D.T.S. No. 13 MINE AREA · NEW ABERDARE EAST

CROSS SECTIONS

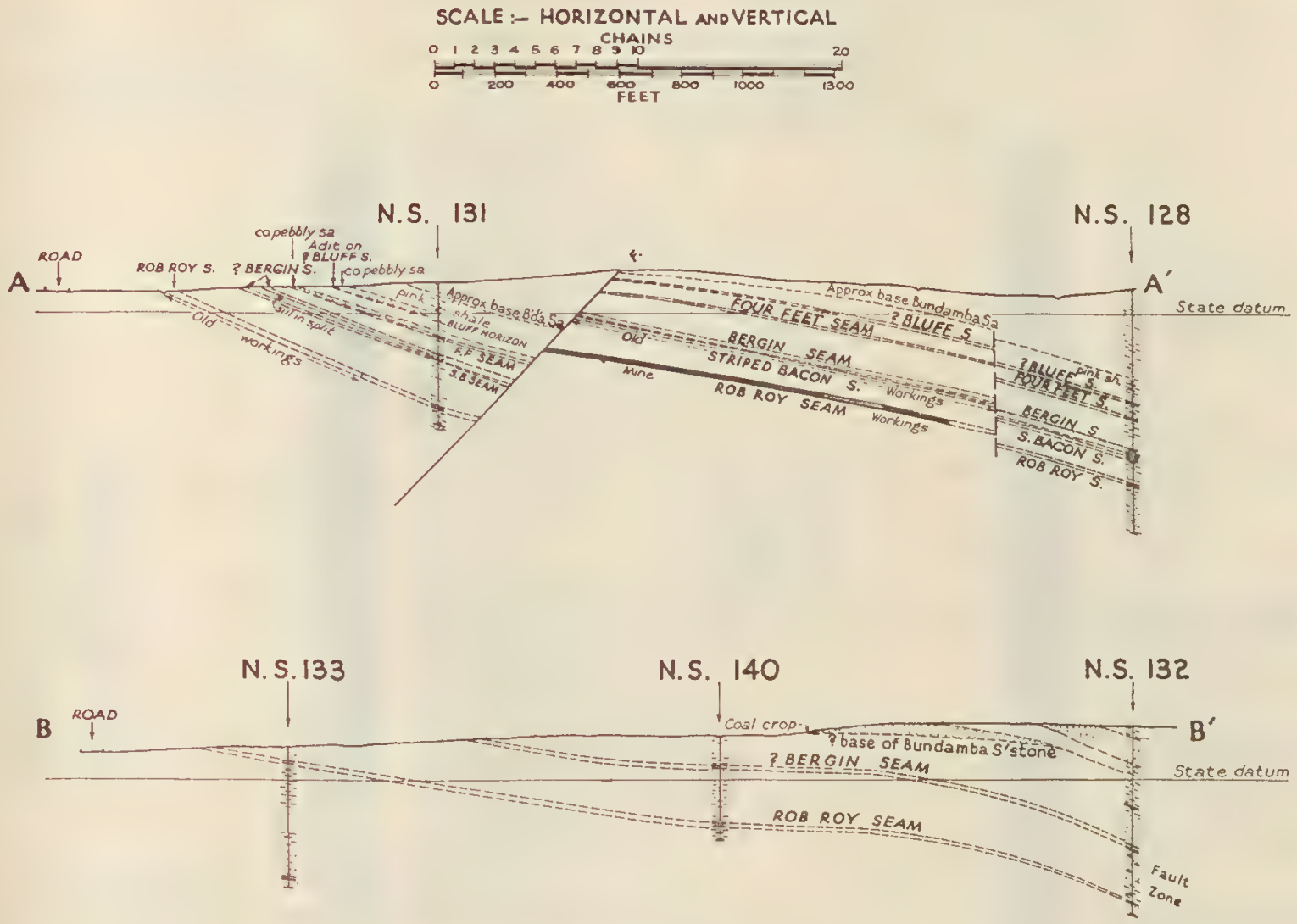


FIG. 5

P.D.T.S. No. 13 MINE AREA · NEW ABERDARE EAST

GENERALISED BORE SECTIONS

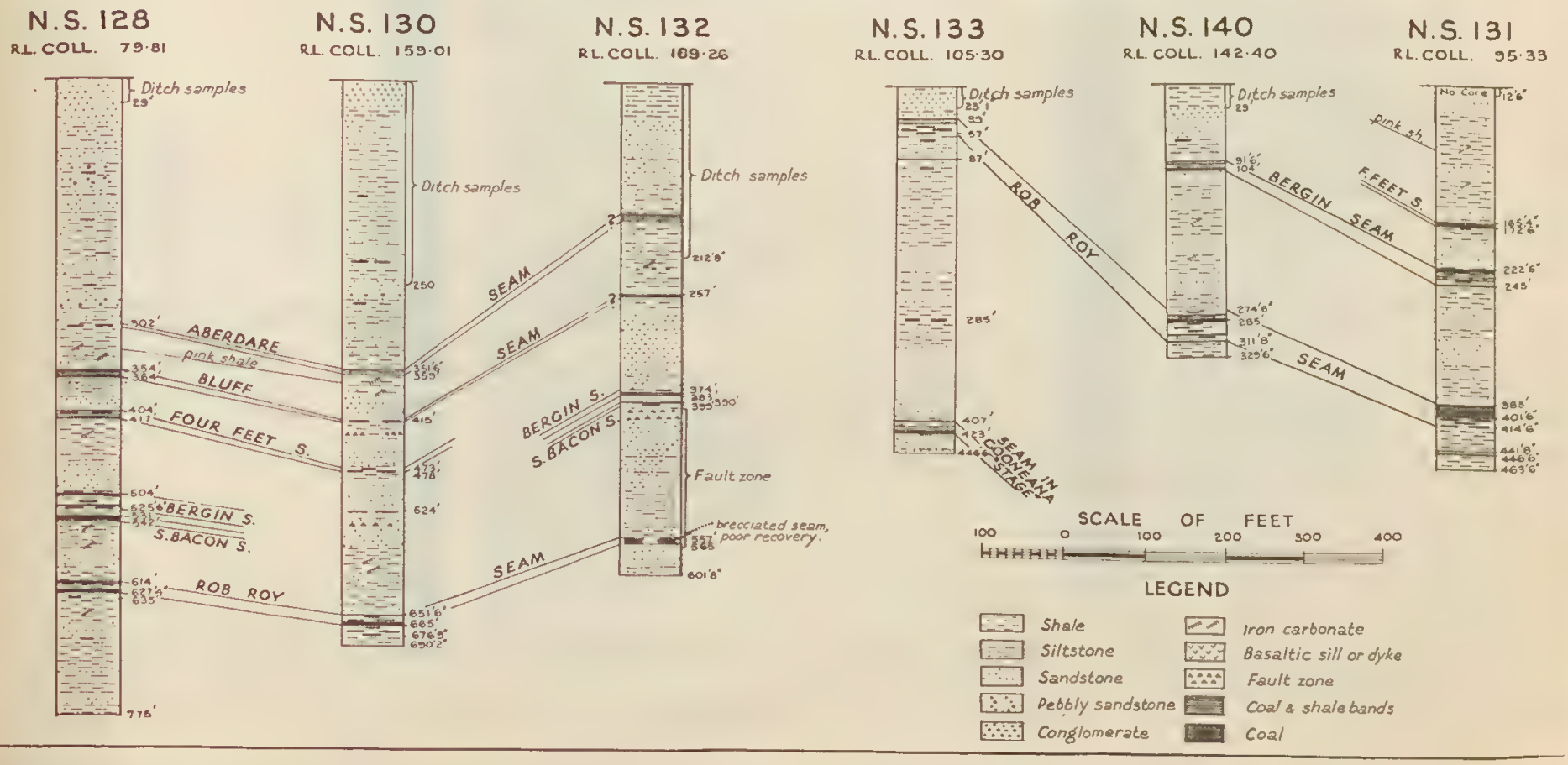


FIG. 6

P.D.T.S. No. 13 MINE AREA · NEW ABERDARE EAST

DIAGRAMS OF ROB ROY SEAM · DETAILS OF CORE RECOVERY AND ANALYSIS

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	N.S.128	Description
M.I 1·5 V.M.I 31·2 F.C.I 43·5 **A.I 23·8** S.I 0·23 Joules/Gm. 25,010 B.T.U./lb. 10,760 S.G. 1·479	100%	484/55	614'4½"	Roof: sh; 1" inf. coal, ¾" med-dk. gy sh; 5½" (p.bkn) coal, inf. in part; 6" (p.bkn) coal, bright, 2" coal w carb sh lam; 1" carb sh, 1" fn sh; 7" carb sh, w some p.b. coal bet. 4½"&6"; 5" coal; ¾" inf. coal; ½" irr. l gy sh bd; 1½ carb sh; ½" fn. sh.; 1" carb sh; 7¾" coal – inf. blm ½"; ¾" irreg lens l gy sh, 3½" carb. sh; ½" med gy sh; 1½" inf. coal, 1½" med gy sh; 8" inf. coal w 1" carb sh fr. 3½"-4½", 1¼" carb sh; 1½" l.br. sh; 1½" carb sh; 1½" fn. sh; 1½" carb sh – inf c in mid, ¾" fn-br sh, ¾" carb sh, ¾" coal, ½" fn. sh, ½" carb sh, 2¾" (bkn) coal, 1½" l gy sh; ¾" carb sh, 7" (bkn 4·7) coal, inf. in top 1"; 5" fn. sh. w cr. fruble bd. blm ⅜"; 2½" carb. sh; 1" l gy. sh; ¾" puggy fn & d gy. sh, 2" (p.b) bluey; 1¼" fn sh; 2½" inf. coal; 1¾" fn – cr. sh; 3¾" (bkn) carb sh. & bluey,
		Excluded	622'5½"	1" fn. sh; 1½" (bkn) carb sh;
			621'1½"	1'1¼" (bkn) coal, w fn sh parting near mid, 2" irreg r'bedded fn & carb sh;
	100%	485/55	620'11"	2'2½" (bkn) coal, w. 2½" boulder at 1'5" fr. top;
Ash. Wash. Floats at 1·4 2·1 10·1 1·6 25·6 24·6 1·8 20·1 48·5 Sinks at 1·8 39·2 86·4 On comp of floats: M.I 1·7 V.M.I 27·1 F.C.I 45·8 **A.I 27·4** S.I 0·22 Joules/Gm. 23,970 B.T.U./lb. 10,310 S.G. 1·516			619'4½"	4½" carb. sh; 3½" (bkn) coal, 1½" (p.b) dk. gy. sh; 8" (bkn. 2·5?) coal, inf. in part;
			617'4½"	6" dk gy sh w carb sh bands, ¾" inf. coal, ¾" dk gy sh, 1½" lt gy sh, 2½" carb sh, 1⅝" inf. coal – coal, 2" carb. sh, 1¼" coal, 7" very inf. coal, w ½" dk gy. sh 1½" fr top, 3" blk. sh., $FeCO_3$ gr. in blm ½", 1⅝" carb sh; 1" fn. sh; 1" carb. sh; 2" lt. gy sh; 7½" carb. sh, w lenses inf. coal, $FeCO_3$ gr. in blm 1½", 1¾" fn. sh; 4" carb sh. w ¾" fn. sh a w. ½" coal at 2"; 1" lt. gy sh; 1½" bluey; 2¼" inf. coal, 7" carb. sh; 1" lt. gy. sh; 1" blk. sh; 7" carb. sh, ¾" m gy. sh. 4" fr. top;
			610'5½"	11" dk gy sh. w carb. sh bands in blm 6"; ¾" fn sh., 2" inf coal, 4" med. gy sh; 2" coaly sh; 4" (part. bkn.) coal, 5" carb. sh., w l gy sh. lam at blm;
Overall Recovery 99·4%			609'5"	Floor: sh.

N.S.131

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	N.S.131	Description
M.I 2·1 V.M.I 30·9 F.C.I 61·5 **A.I 15·6** S.I 0·33 Joules/Gm. 28,200 B.T.U./lb. 12,140 S.G. 1·588 Coking test: Class. Cm Swl. 4	31·9%	147/56	585'0½"	Roof: sa. 3½" (bkn) coal & inf. coal w. ½" l gy. sh. band; 1" carb. sh; 5½" (bkn.) coal; 1" carb sh, ¾" coal, 2¼" carb. sh, 1¼" coal – inf c, 4½" carb. sh, 2" coal, 1" inf coal, ¾" m gy sh; 1½" carb sh; ½" l gy. sh, 12¾" (p bkn) coal,
			573'	1" m gy sh, 1" carb. sh, ¾" coal; ½" carb sh; 1¾" m gy sh; 1" carb. sh; 1½" m-dk. gy. sh; 6¾" (p.bkn.) coal; 1¼" carb. sh; 3" inf. coal, 1½" lt. gy sh; 1½" carb. sh, 1½" med gy sh; 5⅝" inf coal – coal in blm. 1"; ½" l gy sh; 3" coal; ¾" m gy sh; 7" (bkn) coal;
			566'	7¾" l gy. sh. w. l. carb, 1¾" carb. sh; 1½" l gy. sh; ½" carb sh; 1" dk gy sh; ¾" ibed. buggy f & d gy sh; 2" carb sh, ½" coal; 1¼" fn. sh., friable; 3½" carb. sh w many lents coal, 1" coal, ¾" m gy sh, ¼" carb sh, 1" coal, ¾" inf coal, 2¾" l gy – fn sh, 2½" inf. coal w ½" carb sh at 1¼" fr. top; 2¼" carb sh, 1½" (p.b) very inf coal,
			557'10"	1¼" carb sh, ¾" l gy sh impreg w i carb, ¾" (b) in coal, 1" carb sh, 1" lt. gy sh, 2⅛" carb sh; ⅛" coal, 1⅛" carb sh. w coal lents; 1½" lt gy sh;
			553'8½"	4¼" coal, w vert bands sh, ¾" carb sh; ⅜" (b) coal, 1" lt. gy sh, ½" carb sh, 6" coal (bkn in top ½"), ¾" carb. sh, 1½" l-med gy sh, 7¼" coal (p bkn in blm 2");
Coking test: Class. Cw Swl. 1½	100%	148/56	540'4½"	1½" bluey; ½" coal, 1" carb sh; ½" coal, 1½" l gy sh, ¾" carb sh; 5" l.-med gy. sh,
A.I 56·6 M.I 2·8 V.M.I 34·1 F.C.I 41·8 **A.I 31·8** S.I 0·24 Joules/Gm. 21,910 B.T.U./lb. 9,480 S.G. 1·569	100%	145/56	538'8½"	1¼" carb. sh; 2½" (bkn) coal; ¾" carb sh; ¾" l gy. sh; 2¾" coal w vert bds sh a little coal, 2½" carb sh, ¾" coal, ¾" l gy sh; 1" carb sh, 3" coal; 2½" carb. sh w num. coal lam; ½" l gy sh; 1¾" coal w vert. sh & coal bds, 2½" carb sh (b in blm ½"), 2" (bkn) coal, 1½" lt. gy sh; 2" carb sh w num coal lents – inf coal bl m ½"; 1" lt. gy sh 3" carb sh w many lents coal, ¾" coal, 1" l gy sh; ¾" carb sh, ¾" lt gy sh., ¾" coal, ½" carb sh; 4½" med gy sh; ½" carb sh.; 1½" coal w some cal str; 1½" carb sh, ½" l gy. sh; ½" carb sh; ¾" (p.b) coal; 2" l gy sh; 2" coal (p.b. in top 1"); 6" l.-med gy sh; 1¾" coal; ½" carb sh; 2¼" coal; ¼" carb. sh; 1½" coal; 10" carb sh. w coal lam & lents;
Overall Recovery 94·1%			529'4½"	¼" coal 8" med.-dk. gy sh; 4" coal; 1'1½" carb sh, ¾" coal, 1½" carb sh; 1½" coal; Floor: coal & sh. bands.

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	N.S.130	Description
A.I 38·7 M.I 2·2 V.M.I 29·4 F.C.I 48·0 **A.I 20·4** S.I ·046 Joules/Gm. 25,790 B.T.U./lb. 11,100 S.G. 1·448 Coking test: Class. Cs Swl. 6 **A.I 42·4**	100%	143/56	851'6"	Roof: sh; 8½" bluey; ¾" dk gy sh; ¾" coal; ¾" med gy sh, 1½" coal, 4¾" carb sh;
			846'10½"	10" coal, 1¾" fn & carb sh lenses; 5½" carb. sh; 1¾" l gy sh; ½" carb sh; 2½" coal (fn sh lents ¼", ½" l gy. sh; 2" carb sh; 2" inf coal – coal ½";
	100%	148/56	841'10½"	5" coal, inf bet. 3"&4"; ¼" dk gy. sh; 1½" carb. sh; 1⅝" dk gy sh. (irreg), 3⅜" coal w ¼" d gy. sh at ¾" & 3½" cb sh at 2"; ¾" carb sh, 4½" carb sh; 1¾" m gy sh at 1½"; 1⅛" fn sh, ¾" carb. sh; 1¼" (p.b) coal; ¾" br. sh, 5" carb. sh w ⅛" fn sh lens at l, 4" coal, 1½" fn. & carb. sh. lenses;
			835'6"	8" coal, 5" fn. sh.; 2¾" carb. sh.; 1" fn sh, 1¼" puggy fn. & dk gy sh. lenses i bd.; 4" inf. coal, 2½" carb. sh.; ½" lent" l gy. sh.; 5" (bkn) coal,
			832'2"	1" carb – blk sh.; 1" lt gy sh, ¾" fn sh; ½" lent" carb sh; ½" fn sh; ½" carb sh; 2¼" (p.b) coal, sl. inf;
			830'10½"	4" bluey – inf. coal; 1½" l gy – fn. sh.;
			824'8"	6½" coal; ¾" l gy sh, 7" (p.bkn) coal, ½" l gy sh;
			822'6"	2'2" (p.bkn) coal, bluey band between 5" & 4" fr. top;
			819'8"	½" med gy sh; ¾" coal; ¾" carb. sh; 1" br. sh; ½" carb. sh; 3" inf. coal – coal 1¾";
	100%	144/56	818'5½"	3" coal w ¼" med-dk gy sh 1½" fr top;
			816'5½"	2'1 gy – fn sh; 1½" carb sh; ½" fn. sh; 1½" carb. sh., 1" l gy. sh; 3¼" carb sh, ¾" l gy. sh; ½" carb sh; 2" inf. coal, 2" carb. sh; ¼" coal – inf. coal 2";
			812'5½"	3" boulder; 1" carb. sh; 1½" fn. sh; 1" carb. sh, 3½" lt gy. sh, 1¼" carb. sh – inf. coal; 1½" coal; 1¼" l gy sh, 1" coal, 1" carb. sh; 1½" coal; ¾" carb sh; ¾" l gy. sh; 2¼" coal; 1¼" irreg. r bedded carb sh & l gy sh; ¾" coal; 1" l gy sh – fn. sh.;
			806'5½"	6½" carb. sh. w ½" l gy. sh. at 4"; 1¼" fn. sh.; 6" inf. coal, sh. lenses bet. 4" & 5"; 5" dk gy – l gy. sh ½"; 4½" inf. coal w 1" bd carb sh; ½" dk gy sh; 1½" fn. sh, 4" carb. sh; 4½" lt gy sh w. iron. carb gr. in btm 1"; 7½" coal,
			794'5½"	5½" carb. sh; 4¾" med gy sh; 5½" carb sh. w few sh lenses & coal bds, (coal est bet 4"-6"),
			788'5½"	1" lt. gy. sh; 2½" carb – blk sh; 2" lt gy. sh; 2½" dk gy sh; ½" lt. gy. sh; 1⅜" (bkn) coal; 2¼" carb. sh. w. infer. coal bands; 1" (p.b) coal; ½" dk gy sh; 4¼" lt gy. sh;
			783'5½"	7½" (p.b) coal, 1¼" fn. sh; 4½" dk gy. sh; ¾" lt gy sh; ½" carb sh;
Overall Recovery 100%			776'5"	4¼" coal, Floor: sh

N.S.133

Prox. Analysis S., Cal. value, S.G.	Recovery percent	Section Sampled	N.S.133	Description
			58'11"	Roof. f sa
				9½" coal, (bkn in top 3")
				1" carb sh; 1½" coal, ¾" dk gy. sh;
				5½" (bkn) coal, inf coal & carb sh;
				½" carb sh; ¾" coal, ¾" coaly sh; ¾" dk gy sh.,
				1¼ carb. sh; ¾" coal, 1⅝" fn. sh; 1" coaly sh;
				1¾" fn. sh; 3½" (p b) inf. coal & coal;
				2½" carb sh; 1¾" coal, ½" carb sh;
				1½" fn. sh., ¾" inf coal, 1¼" fn-br. sh; ¾" carb. sh, 1" coal,
				¾" fn. sh., 1" carb sh; ¾" coal, ¾" carb sh, ½" coal,
			44'1¼"	2½" dbr sh w i carb; ¾" inf coal; 1" fn sh; 1" carb sh;
				¾" coal, 2" carb. sh; 2¾" coal & inf coal, ¾" carb sh;
				5½" fn. sh;
				¾" br. sh; 1¾" carb sh; ¾" br sh, ½" carb. sh;
				¾" fn. sh; ½" carb sh; ¾" fn. sh; 2¾" carb sh;
				2" (bkn) inf coal & carb sh; ¾" carb sh; ½" coal,
				2" (bkn) fn sh; 3¼" (bkn) carb. sh. a little inf coal,
				1¾" (bkn) coal; 3¾" fn. sh,
			47'0¾"	5" (p bkn) coal, w. ¼" carb. sh. bd. ¾" fr. blm;
				1¼ fn. sh; ½" carb sh; 2" boulder,
				1'1⅝" coal – inf coal in places,
				¾" carb sh; ½" med br.-gy. sh;
				5½" (bkn.) carb. sh,
				2" fn. sh; 1½" carb sh. & some coal; 2¾" fn. sh,
				½" carb. sh, 1" coal; ½" carb. sh;
				1¾" coal; ¾" carb. sh, 2" fn. sh;
				11¾" (bkn) carb. sh & some inf. coal,
				3¾" fn. sh;
				2" carb sh (bkn. blm. 1") w. lam. coal, 1¾" fn. sh,
				¾" coal; 3½" (bkn) carb. sh w lam coal & a little coal,
				¾" fn. sh; 4½" (bkn) carb sh w coal lam & a little coal,
				¾" fn sh; 4" (p bkn) carb. sh. w coal lam;
				½" fn sh, 2" shaly coal; ¾" fn. sh;
				3¼" carb sh (p bkn), ¾" fn sh;
				4½" inf coal – coal in places;
				1⅝" carb sh, 1⅝" coal, 1" fn sh,
				2" coaly sh;
				9" fn. – br. sh;
				2" (p. bkn) carb. sh.;
				11" (part bkn) coal,
				8" carb sh,
Overall Recovery 92·1%			56'9"	Floor: sh.

29 SEP 19

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DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND

(A. K. Denmead, M.Sc., Chief Government Geologist)

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THE OPAL-MINING INDUSTRY AND THE DISTRIBUTION OF OPAL DEPOSITS IN QUEENSLAND

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THE OPAL-MINING INDUSTRY AND THE DISTRIBUTION OF OPAL DEPOSITS IN QUEENSLAND.

HISTORY OF THE DEVELOPMENT OF OPAL-MINING.

After a short era of prosperity there has been a very considerable decline in the opal-mining industry of Queensland, the cause of which is not far to seek.

It is entirely owing to the persistent and widespread drought which has prevailed over the western portion of the State for the last six years; a drought which, when at its height, was so severe as to render prospecting and mining for opal almost impossible.

There are no very reliable records of the annual output of opal in Queensland, but those at our disposal are as follows:—

Year.	£.
1891	3,000
1892	10,000
1893	10,000
1894	12,000
1895	32,750
1896	23,300
1897	10,250
1898	6,645
1899	9,000
1900	6,500
1901	7,400

and clearly show the fluctuations of the production with the seasons; the best conditions prevailing in 1895 and 1896.

The figures for 1899, which was one of the most severe years of drought, are apparently too high, but this may have been caused by the fact that the employment of labour on stations, &c., then reached the minimum, and consequently a greater number of men for a short time turned their attention to opal-mining.

At present about 295 men are engaged in the industry.

There is no record of the first reported discovery of precious opal in Queensland, but there appears to be no doubt that saleable gem stones were first obtained from the old opal mines near Listowel Downs Station, the occurrence of the mineral there being made known by some stockmen or drovers.

Probably one of the first regular opal-miners was J. Bridal, the original owner of the Little Wonder Mine, who is still mining in the same district.

The first activity in the industry took place in 1878, when the Aladdin Mine, which was portion of a freehold grant of land made to Mr. Bond for the purpose of developing the trade, was floated into a company in London by that gentleman. Before this, however, great interest was taken in the matter by the Hon. John Webber, M.L.C., of Kyabra Station.

The total value of gem stones produced from all opal-fields in Queensland is, as nearly as can be estimated, £131,000, or, up to the end of 1899, £116,000. This amount compared with £376,000—that of New South Wales, the only other producer of any quantity among the Australian States—is small, seeing that the whole of the latter amount was produced from the one source alone, the White Cliffs Opal Field, the output of which for one year was £135,000.

From the other two principal sources of precious opal—Hungary and Mexico—there are no records available of the production of the mineral, nor of that of South Australia or Victoria, where, however, it has only been obtained in very small quantities.

Precious opal occurs in Queensland in two geological formations, viz.—in sedimentary rocks of Upper Cretaceous Age, known as the Desert Sandstone Formation, and also in vesicular basalt of later geological age.

The geological conditions under which opal occurs in the former—which is analogous to the occurrence at White Cliffs in New South Wales—is wholly distinct from any previously known opal deposit in the world.

The latter mode of occurrence in a vesicular basalt is analogous to those of Hungary and Mexico, but, so far, Australian deposits of this kind have not been worked commercially.

GENERAL GEOLOGY.

The Desert Sandstone rests horizontally, and with unconformability, on the lower Cretaceous rocks or Rolling Downs Formation.

Of the latter, Mr. Jack has stated* that it marks the position of a sea which, in Cretaceous times, divided the Australian continent into two islands.

As will be seen from the geological map, it covers an area which may be roughly stated at three-fourths of the total extent of the State. It extends westward from the Palæozoic Range on the east coast, from near the heads of the McIntyre in the south, to the Palmer in the north; west of this line it occupies the whole of the State, save where it is unconformably overlaid by the Desert Sandstone, and where the Palæozoic rocks of the Cloncurry and of De Little, Cairn, and Grey Ranges rise from beneath it like islands.

Westward and southward it extends across South Australia into Western Australia and New South Wales, but except in Queensland it appears to be covered to a considerable extent by tertiary rocks.

* Geology of Queensland, Chap. xxxi.

As follows from its mode of origin, the Rolling Downs Formation consists of a series of sandstones, shales, and other sedimentary rocks.

Of the Desert Sandstone Formation, Mr. Jack states* that, after the Rolling Downs Formation had been laid down in the comparatively narrow sea which connected the Gulf of Carpentaria with the Great Australian Bight, a considerable upheaval took place, and the denudation of the Rolling Downs Formation followed, and must have gone on for some time.

Unequal movements of depression then brought about lacustrine conditions on portions of the now uplifted bottom of the old deep-sea strait, and in other portions permitted the admission of the waters of the ocean.

Finally a general upheaval placed the deposits of the period just concluded in nearly the positions in which we now find them.

There is abundant evidence in Queensland that the upper Cretaceous rocks of the Desert Sandstone Formation must at one time have covered almost the whole of the Rolling Downs Formation, and occupied a similar area of about three-quarters of that of the whole State, or 500,000 square miles.

Its denuded remains now occupy less than the twentieth part (25,000 square miles) of the area over which it originally extended.

The remaining portions of the Desert Sandstone are now only seen in the form of low ranges, tablelands, and isolated flat-topped hills, and such areas of the formation occur at frequent intervals, chiefly within the limits already defined in the western portion of the State. There are also other small detached patches and a large area covering the greater portion of the Cape York Peninsular.

EXTENT OF PROSPECTING.

The deposits of precious opal are found wholly in these outlying patches of the Desert Sandstone, and the country within which prospecting for the gem has so far been carried on may be generally stated as extending from the southern boundary of the State to Kynuna beyond Winton, and to be limited on the east by the termini of the main trunk railways, or, roughly, a line joining Charleville, Longreach, and Hughenden; the mean width of the area would be about 250 miles. On the accompanying map of this portion of the State the position of the principal opal-fields and deposits of the mineral is shown, and also the extent—as well as the records at present available will enable it to be mapped—of the areas of Desert Sandstone in which they occur.

These upper Cretaceous rocks, as they are now seen, have here a thickness of from 100 to 200 feet, though rarely more than 160 feet.

Stratigraphically there are two well-marked divisions consisting of soft sandstones and clays, and overlying them extremely hard siliceous rocks, the latter having a thickness of from 15 feet to 50 feet, and remaining as a capping to the hills and outliers.

This siliceous capping, generally white or stained by oxide of iron, appears in a number of different forms, it being just above the softer sandstones for a thickness of 8 or 10 feet, fine-grained, and evenly deposited, and very frequently converted into a porcellanite.

Above this level it is generally more uneven in texture, and has the cement-like appearance of a hardened coarse clay; it is also extremely hard, and known as "Top Rock" among opal-miners.

In many places this rock assumes a kind of nodular or spherical structure, and there has apparently been a tendency to the solution and redeposition of its siliceous constituents.

The surface of the outlying hills and tablelands is frequently covered with a débris, consisting of rounded or ellipsoidal boulders, from 6 to 12 inches in diameter, and slag-like masses, intensely hard and flint-like, which ring like metal under the hammer, and break with a conchoidal fracture. Moreover, the rock being so intensely hard, its remains are found in the form of small, round boulders, known as "Water Dogs," which thickly cover large areas and patches of country on the flats and plains, even after the greater portion of the rest of the formation has been entirely removed by denudation. Beyond their somewhat similar appearance, however, to the ordinary water-worn pebbles, there is no reason to suppose that their form is due to the action of the water.

The same rock, which forms the summit of nearly all the outlying hills and ridges, has been described at different times as quartzite, porcellanised sandstone, &c., but there is no apparent geological reason for separating any one portion of the siliceous capping from another—from the fine-grained rock or porcellanite at its base to the hard flint-like débris on the surface—they being but different varieties of the same rock with characteristics produced by somewhat different conditions of deposition or subsequent metamorphism.

Of the softer sandstones and clays which underlie the siliceous capping, the thickness is variable but rarely exceeds 40 feet. The upper portion is generally harder, and has a pink colour due to the chemical form of its ferruginous constituents, while the lower portion and clays are generally yellow or grey in colour, being also very gypseous, and there is frequent evidence of false bedding in this part of the series.

The weathering of the formation is extremely rapid, and the characteristic form which the outliers present is that of a vertical escarpment, for the thickness of the siliceous capping, and a gentle slope formed by the underlying softer sandstones and clays at the base, which in weathering often give rise to flats and plains of very considerable extent.

* Geology of Queensland, Chap. xxiii.

MINERALOGY.

Opal consists of hydrous silica, the proportion of water varying from 2 to 13 per cent. in different varieties. The mineral is softer than quartz, the hardness varying from 5·5 to 6·5, while that of quartz is 7. Its specific gravity ranges from 1·9 to 2·3.

It differs also from quartz in not crystallising in any definite form. Its lustre is vitreous, often inclining to resinous, and sometimes pearly.

It sometimes presents a brilliant play of colours, and is then called precious or noble opal. Other varieties are known as common opal, milk opal, wood opal, fire opal, &c.

The cause of the play of colour on precious opal is a question which has given rise to some controversy, but there appears to be no doubt that the phenomenon is not due to chemical composition, but rather to the influence of slight differences of physical structure or its power of refracting light.

MODE OF OCCURRENCE.

The deposits of precious opal in Queensland occur almost entirely in the softer beds underlying the siliceous capping of the Desert Sandstone series, but in one or two instances the gem has been found in the porcellanite immediately overlying them.

There is everywhere a tendency to opalisation in the Desert Sandstone; common forms—wood opal, semi-opal, &c.—occurring throughout. Precious opal, however, has only been found here and there in small patches.

The opal which is found may be roughly divided into two classes, known to miners as "boulder" opal and "sandstone" opal respectively, the mode of occurrence of both of which will be fully described in detail hereafter.

Boulders are nodules of siliceous ironstone of concretionary origin which contain precious opal and occur in the opal-bearing sandstones and clay at all depths.

The opal-bearing stratum "band" in which the sandstone opal is found occurs in the falsely-bedded series of sandstones and clays at the base of the sandstone, and at its junction with the underlying clay.

It is found occasionally on the surface, but generally at some distance below, the average depth of shafts being about 14 feet. The deepest shaft is about 65 feet. As the term "band" is rather indiscriminately applied on different fields for the particular portion of the formation from which the supply of gem stones is obtained, it may be advisable to explain its most general significance.

Between the clay and the overlying bed of sandstone there is almost universally a thin perfectly defined stratum, varying from a film to 1 or 2 inches in thickness of highly ferruginous and siliceous material which can be easily separated from either the clay or the sandstone, and which is generally called the "casing."

Immediately above this casing the base of the sandstone for a thickness of from 2 or 3 to 12 or 18 inches is generally more ferruginous and somewhat hardened, and though there is no well-defined line of separation, this portion may be detached or broken down, and it parts from the main mass of the sandstone along a plane of weakness approximately parallel to its under surface or junction with the clay. This hardened portion is generally called the "band."

Precious opal is obtained in various localities from the clay, from the casing, from the band, and from the main mass of the sandstone.

Sometimes the mineral is found scattered over the surface, being set free by the denudation of the rock in which it was formed, but, as a general rule, there is little or no evidence of the whereabouts of valuable patches of mineral below. Prospecting for opal is a decidedly hazardous business, and the site for a shaft is most frequently chosen at haphazard in the vicinity where some scattered specimens (colours) have been found on the surface.

Exploratory drives are sometimes put in, but opal-miners, unless the gem is met with in the shaft itself, as a rule, do very little driving, frequently abandoning their shafts without any adequate trial, and often never even piercing the strata above the opal-bearing band.

MINING OPERATIONS.

Mining operations are very simple, the sandstone being generally soft, and requiring no more than the pick to work it. Blasting is only occasionally resorted to, as gems when won in this manner are usually cracked so much as to be worthless, owing to the shattering effect of the explosives which are not generally suitable for opal-mining.

All the tools of trade can be carried on a packhorse, green-hide buckets and plaited ropes of the same material being frequently used, and a windlass constructed at the site.

Usually, however, a considerable quantity of stores, &c., has to be carried, and the majority of miners find a horse and dray a necessary part of their equipment.

VARIETIES OF OPAL.

There are a great many varieties of precious opal found, some of the different kinds being distinguished by their "pattern" as "pin-fire," flash-fire, or flash opal, when the colour shows as a single flash or in very large pattern, and Harlequin when the colour is in small squares or chequers, the more regular the better. The latter is the most uncommon, and also the most beautiful.

Such classification, however, conveys no idea of the innumerable and exquisite varieties assumed by the gem.

QUALITY OF OPAL.

Nearly all the different varieties of opal are found in Queensland, and there can be no doubt whatever that the quality and brilliancy of some of the best of the gem stones which have been obtained from the deposits of the State is quite unsurpassed.

More than 90 per cent., however, of all of the opal obtained is valueless, being common opal, "schnide" of the miners, or of the glassy bluish variety containing little or no colour.

MEANS OF DISPOSAL OF THE GEM.

The means of disposal of the gem are very irregular and by no means satisfactory.

The gem stones are sold to visiting buyers, of whom there are now few and amongst them little competition, and also to some of the more prosperous miners and hawkers, who become buyers in a small way. Some is even taken by the miners themselves to sell at the White Cliffs Opal Fields in New South Wales, but by far the greater proportion is sent to gem merchants in the southern States, chiefly South Australia and Victoria, and parcels of opal frequently pass several times by post before being sold.

Opal in the rough has generally more or less of the matrix attached, and sales are effected either by simple bid for the whole parcel or at so much per ounce, the price paid varying from 10s. upwards, but rarely exceeding £40 or £50 per oz. The best clean opal has been sold at from £1 to £1 5s. per carat, and occasionally higher.

There cannot be said, however, to be any fixed value for the few gems obtained of highly exceptional quality, or for opal of inferior quality, for which the price paid most often depends on the fancy of the individual purchaser. While the best variety of gem stones obtained in Queensland are in most instances readily saleable at a price comparing favourably with that obtaining elsewhere, there is no doubt that a great deal of opal is sold at a price far below its value, owing either to necessity on the part of the miners or to its quality not being recognised. The great difficulty is in finding a satisfactory market for opal, which, though very beautiful, is not of the best quality, or of fashionable variety, and which forms a large proportion of that obtained—indeed, the sole winnings of the less fortunate miners.

This has generally to be disposed of at a price in no way giving a fair return for the labour of obtaining it, and it is to be regretted that a better value cannot be obtained, and more reliable market found for it.

Though the actual commercial value of inferior opal, and the consequent profit in buying and selling it, may not be sufficient to enable it to be disposed of on the most favourable terms to the present buyers of Queensland gems, which in the ordinary course are ultimately exported to European and other markets, there is no doubt that the usefulness of this class of opal is not appreciated, nor its value fully recognised by gem-workers and others in Australia, where very little attempt is ever made to use any opal which cannot be fashioned into the common oval shape and mounted, as is frequently the case with some cheap and poorly-designed form of setting.

With the development of the goldsmiths and silversmiths' craft, however, as an important artistic factor entirely distinct and apart from the subsidiary task of stone-setting, there is now a widespread movement for the production of jewellery on the æsthetic principles, and where stones do happen to be employed there is an increasing practice of introducing them for the sake of their decorative properties, not as formerly for the sake of the commercial value they represent.

Mere glitter and display of affluence are gradually yielding before higher considerations of beauty of form and colour; nor is it any longer deemed improper should the æsthetic effect of juxtaposition demand to set diamonds or other valuable gems side by side with common and inexpensive stones.

In these colour combinations, since flash and transparence are become of minor esteem, jewels instead of being cut in facets are not unfrequently polished in their natural shape—"enchabochon" or "tallow cut," as it is called—the irregularities of formation in many, such as pearl blisters, &c., which are very frequently used, imparting not a little to the barbaric richness of the ornaments in which they occur.

Moreover the taste for colour effects in jewellery has led to an enthusiastic study of the special pecularities of many precious stones not hitherto much sought after, nor very precious, yet, like the commoner and less fashionable varieties of precious opal sufficiently rare.

The inferior though beautiful opal which forms so large a proportion of that obtained by opal-miners in Queensland as well as the numberless pieces which, even though of really good quality, are rather thin, or for other reasons unsuitable for shaping into the ordinary production of the lapidary, undoubtedly possess those peculiar qualities of chameleon iridescence or depth of lustre, that render them admirably appropriate for quaint and picturesque settings; and I feel convinced that both these products are much too readily discarded.

One great advantage of the use of these less perfect gems is that on account of their comparative cheapness one does not scruple to diminish and divide and fashion them as may best serve the purpose to hand, whereas in the case of the more precious stones, like diamonds, where cost, ceteris paribus, increases proportionately with size and weight, one shrinks from impairing their commercial value, and consequently is apt to preserve them whole, very often at the sacrifice of decorative effect.

The irregular methods of disposal of opal at present existing makes it quite impossible to maintain any reliable record of the value or output from the various sources, or to accurately gauge the progress of the industry or its value to the State, and for these reasons it would appear advisable that by some means the process be regulated.

Though the opinion of a number of those engaged in the industry seems to be averse to any restriction being placed on buyers, I believe that the registration of all buyers, as well as opal-cutters, would be advantageous in many ways, not only to promote the regulation of the disposal of opal, but also to enable statistics to be collected with greater accuracy.

A similar recommendation was made by the Royal Commission appointed to inquire into the opal-mining industry at the White Cliffs, New South Wales,* and it would no doubt be advisable to adopt the suggestion contained therein, that the process of registration be made easy, and the fee a small one.

The occupation of an opal-miner is more in the nature of fossicking than mining, since he works over an extremely large tract of country, quitting one place for another, either because unsuccessful in finding the gem, or compelled to move on account of the scarcity of water. Moreover, much the greater proportion of opal-mining is not within the limits of any proclaimed mineral field, thus:—

Mineral Fields.	No. of Opal Bearing Localities.	No. of Miners.	Production for 1901.
			£
Cunnamulla	4	41	2,000
Paroo	11	83	1,750
Opalton	13	74	2,100
Windsor	3	..	100
Not in any proclaimed mineral field	69	95	1,450

and there is no doubt that existing conditions are somewhat different to those anticipated when framing the regulations under which the industry is carried on.

While it would obviously be impossible to bring all the opal deposits within a proclaimed mineral area, it would appear advisable that the tenure provided by the Mining Act be made better applicable to more or less permanent mining of this class on certain portions of Crown lands leased for pastoral purposes, wherein are most of the deposits which are outside the four declared mining fields.

Moreover, owing to the shallowness of the deposits, and the ease with which the opal can be mined, it is not advisable that any large areas be allowed to be held, and conditions being somewhat analogous to ordinary alluvial mining, the general consensus of opinion seems to be in favour of the maximum area allowed not exceeding from 50 feet to 100 feet square.

*Report of the Royal Commission appointed to inquire into the Opal-mining Industry at the White Cliffs, New South Wales, 1900.

PROGRESS OF INDUSTRY.

The great difficulty in the way of progress to the industry at the present time is the great scarcity of water, and under the drought of the last five years opal-miners and prospectors have had to work under extreme disadvantages and hardships, rations being very expensive, and even difficult to obtain.

The more established fields have generally a small fairly permanent supply of water in the old shafts and wells, but the majority are less favourably situated.

As a general rule, the men rely on waterholes in the beds of the shallow creeks, and camp on those nearest to the deposit they are working, but as these quickly dry up they have to move from one to another further away, and frequently abandon their work entirely until the next rains.

It is no uncommon thing to see men walking 4 and 5 miles daily to work, and in one instance I saw a man walking over 6 miles and carrying a day's supply of rations and water, of which the daily consumption in the dry western country often exceeds a gallon.

PROSPECTING.

All efficient search for the mineral is therefore limited to a radius of a few miles round the most permanent waterholes, and there is a very large area of country practically out of reach of ordinary prospectors.

There is no doubt that the discovery of new fields would give a much needed impetus to opal-mining, and there is a unanimous feeling on the part of opal-miners that the industry is entitled to participate in the fund for the aid of prospectors.

While there is no reason why existing fields and the country within reach of the prospector should not yet furnish considerable supplies of opal, there are certainly large areas, similar in every respect so far as their geological formation is concerned, where there is every reason to believe that the gem would be found in just as great quantity as elsewhere; but owing to the large extent, frequent scarcity of water, and cost of obtaining provisions and necessaries, there is very little likelihood of thorough and extensive prospecting being undertaken by the individual miner, or by private enterprise, and it would without doubt be advantageous to devote a certain sum to the exploration of the country difficult of access to the ordinary miners, or to the better exploration of existing fields.

PROSPECTING UNDER GOVERNMENT AID.

Since from the very nature of the occupation every opal-miner is a prospector, the question of the encouragement of prospecting under Government aid is a difficult one, and the present time, on account of the abnormal conditions of drought, I fear inopportune. I am, however, of opinion that the most beneficial means of allotting such aid would be in the equipment of small prospecting parties of about four men, and as ensuring that the members of such

parties should be experienced opal-miners, and as also tending to create a sense of trust and confidence in the undertaking, the participators might be advisedly selected by the miners engaged in the industry or by some committee or association representing them, and I understand that some such body exists at most of the principal opal-mining centres.

DESCRIPTIVE REGISTER OF QUEENSLAND OPAL-FIELDS AND OPAL-BEARING LOCALITIES, WITH GEOLOGICAL MEMORANDA.

Preface.

In compiling the following description of the various opal deposits of Queensland no previous information on the subject was available, and recourse was had to visiting the deposits themselves, a work of some magnitude, which unfortunately was undertaken at a rather unsuitable time of the year.

At the time, however, there were indications that the drought conditions which had prevailed for so long would improve, but these hopes were not realised, and consequently the greater number of opal-fields were found entirely deserted. Observations had also to be curtailed and were greatly hampered by the scarcity of water and feed for horses.

A good deal of the information respecting these temporarily deserted opal-fields had to be gathered from conversation with miners met with on other fields, and as such, is liable to inaccuracies.

It was nevertheless the best that could be obtained, so that such figures and amounts as are given can only be regarded as serving to indicate the magnitude of the operations which have been carried on in any locality for comparison with that of others.

The distances given, unless otherwise stated, are always those of a straight line, and are merely to fix the position of the various deposits, which can be located on the map attached hereto.

The distance by road from each place is in every case considerably greater.

The dates given are also subject to inaccuracies, and the "present time," when mentioned, refers to October and November, 1901.

There is a prevailing and universal custom amongst opal-miners to refer to all opal-bearing localities, whether the workings consist of a trench, single shaft, or group of shafts, as a "mine," generally adding the name of the prospector who worked there originally, or obtained the greatest value of gem stones, in the possessive case; and this custom has been retained in the following pages.

The Yowah Opal Field is in the Cunnamulla Mining District 28 miles W.N.W. of Eulo, and is situated on the northern side of Sheep Station Creek 10 miles from its junction with Yowah Creek of which it is a tributary.

The usual means of access to the field is from Eulo, a distance of 37 miles, and the country in the vicinity is generally flat or gently sloping.

The rock consists of the pink sandstone of the lower strata of the Desert Sandstone series, and this, in many places, is covered by the characteristic débris of hard round boulders, derived from the denudation of the harder upper beds which still remain capping several outlying hills. The underlying beds slope gently off and gradually merge into soft red plains and flats formed by their débris. The country is scantily timbered with mulga, leopard wood, &c., and fringing the creeks and waterholes are several species of eucalyptus. The mean annual rainfall is about 12·7 inches and the minimum 6·2, recorded in 1900. The field is dependent for its supply on the waterholes of Sheep Station Creek, which lasted well even in the year of minimum railfall (1900).

As a rule, water can be obtained within a mile of the workings, but occasion has arisen for carting it from a dam 4 miles from the camp. The area of Desert Sandstone in which this field is situated extends north for probably 56 miles, joining the small area which is marked on the map just to the east of Toompine. South it extends about 16 miles, probably joining the Willies Range which then trends off in a south-westerly direction for about 40 miles. The mean width is about 16 miles. The whole thickness of the formation is not *in situ* throughout the whole of this area, but outlying hills, on which the topmost beds still remain, occur at frequent intervals.

The surface of Mount Blakeney, 4½ miles S.S.W. of the field, like that of Mount Wallaroo, 4 miles to the east, is covered with a débris of boulders of the intensely hard quartzitic looking rock, and beneath this is a hard white siliceous rock.

An analysis of the latter, at the base of which were here and there small patches of conglomerate, gave—

SiO_2, 73·4 per cent.; and Fe_2O_3 + Al_2O_3, 22·4 per cent.

These rocks have a total thickness of from 40 feet to 50 feet, and give rise to a vertictl cliff face frequently weathering into large caves.

Beneath are beds of coarse reddish and yellow sandstone, an analysis of which gave—

SiO_2, 58·1 per cent.;

and these latter contain beds of clay and thin bands of highly ferruginous sandstone, there being frequent evidence of false bedding in the series which has a a thickness of about 60 feet. With the exception of Mount Wallaroo and Mount Blakeney, the upper beds in the vicinity have everywhere been removed by denudation, and the surface of the country is covered with the rounded nodules—"water dogs."

The precious opal obtained from the principal "claim" of this field, which is situated on a low ridge about 40 feet above Sheep Station Creek, is found forming the centre or kernel of small nodules of siliceous ironstone—"kernel boulders."

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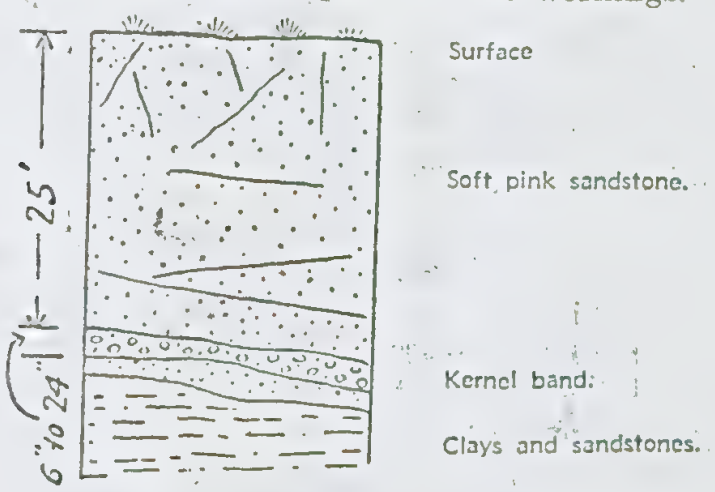
The discovery of opal at the Great Extended was made by Mr. W. Evans when deepening an old shaft that had been left by some former prospector, and it is now one of the richest deposits which is being worked in Queensland. It was first held as a claim, but owing to disputes was subsequently taken up as mining lease No. 6 by Evans, Tullie, Cornthwaite, and Wollaston. This is now the only mineral lease for opal which holds good. The main shaft on the lease is about 26 feet deep, and passes through a soft pink sandstone. At about 25 feet the rock becomes rather harder and has a yellow colour, and the kernel band is met with.

This consists of a bed of concretionary nodules closely packed in soft clayey sandstone.

Beneath it are beds of soft grey sandstone and clay.

The beds have a slight dip of about 10 degrees, but this varies in different parts of the workings.



Section of Great Extended Shaft, Yowah Opal Field.

The upper portion of these sandstones or falsely-bedded strata are as a rule harder than the lower, and near the base of the series thin beds of fibrous gypsum (kopi), varying from ¼-inch up to 2 inches or 3 inches in thickness, are of frequent occurrence. Such beds also occur in the clays beneath the opal band, and in the band itself encasing the boulders.

Detached scattered nodules of siliceous ironstone are seen above the main band as high as 8 feet, and in some cases a second band or nest of nodules is seen about 2 feet above the main one.

These, however, have no appreciable extent, and generally lie at a different angle, and run into the main band.

Examples of opal being found as the kernel of concretionary nodules occur on several of the opal-fields, but the occurrence of the nodules in such numbers in the form of a definite bed or stratum is altogether unique.

The compacted mass forming this bed of kernel boulders varies from 6 inches up to 2 feet in thickness, and has a conglomerate-like appearance. The matrix consists of a somewhat friable sandy mass containing a large proportion of clay in irregular masses and rounded lumps.

An analysis of the sandy portion gave—

SiO_2, 70·8 per cent.; $Fe_2O_3 + Al_2O_3$, 20·6 per cent.;

and of the clay—

SiO_2, 55·7 per cent.; $Fe_2O_3 + Al_2O_3$, 30·1 per cent.; H_2O, 4 per cent.

The kernel boulders are undoubtedly of concretionary origin formed *in situ*.

They vary from about a quarter of an inch up to 6 or 8 inches in diameter, and have generally a somewhat spherical or ellipsoidal shape, the chocolate or brown colour being due to the presence of oxide of iron.

They have evidently been deposited from the outside towards the centre, having alternate rings of dark and light-brown colour, and varying in composition from a siliceous ironstone to a rather ferruginous opal.

An analysis of the rim of a large solid boulder gave—

SiO_2, 27·6 per cent.; $Fe_2O_3 + Al_2O_3$, 67·0 per cent.; H_2O, 0·64 per cent.

In the centre is generally a kernel of pure opal, which, when of the precious or noble variety, forms the source of the gem. Occasionally there is a layer of opal between the outer skins or at the outer edge, and veinlets of opal often ramify through the matrix. The centre of these boulders is not always filled in the same manner, and examples occur of the kernel being composed as follows:—

(*a*) Of precious opal;

(*b*) Of common opal, smoky, clear, or glassy, yellowish, or resin opal, white, yellow, and black;

(*c*) Of the same material as the outer portion sometimes shot through with veinlets of precious opal;

(*d*) Of opal, generally of the glassy variety, but having the kernel quite loose in the shell;

(*e*) Of a fine white powder, an analysis of which gave—

SiO_2, 60·4 per cent.; $Fe_2O_3 + Al_2O_3$, 27·8 per cent.; H_2O, 1·8 per cent.;

(*f*) Of a small quantity of fluid like water;

(*g*) Or the boulders may be quite hollow and have no kernel.

I did not actually see an example of one containing any liquid, but in several that were broken the fine white powder was quite moist, and did not fill the shell.

Mining operations on the field are extremely simple, the soft pink sandstone being easily removed with pick and shovel, and the method of working is roughly as follows:—

A shaft is sunk until the opal-bearing or boulder band is met with, and the material for about 3 feet or 3 feet 6 inches above it is then removed. No system of drives is employed, but the opening out is done in an irregular manner, the band being left on the floor, to be afterwards removed and examined for gems. The sandstone above being fairly compact stands well, and only a few pillars are left here and there to support the roof, assisted by occasional vertical struts with cap pieces. Leopard wood is frequently used for the latter purpose (so-called on account of the peculiar markings of the bark), and this material is found to stand best underground. The shafts are descended in the usual manner common to all opal mines—viz., steps cut at intervals in the walls. A miner can well remove enough of the overlying sandstone in a few hours to supply him with a sufficient quantity of the opal-bearing kernels for examination for the whole day. The band is broken up from the floor with a pick, and the portion removed is either searched for gems in the mine or sent to the surface for examination. As any nodule of this conglomerate-like mass may contain a gem stone, the process of examination must be conducted very thoroughly. The mass is broken to pieces, each nodule being separated by hand, and with a small hatchet and chopping-block the miner proceeds to crack or chop the end off the boulders. Sometimes precious opal of very fine quality may form the kernel of perhaps one in every 50 or 100 that he cuts—a truly fascinating pastime, but crude in its extravagance, as frequently, owing to the brittle nature of the material, most valuable gems are lost, destroyed, or broken in such a way as to be useless. In nearly every case the kernel of precious opal is damaged, or reduced in value and size by the process. A number of the miners are provided with a rough lapidary's wheel, wherewith they cut and polish opal, and also, by their ignorance of the craft, frequently spoil valuable stones. No doubt a lot of gems are either missed, or spoilt by rough breaking.

The extent of the kernel band is somewhat difficult to estimate, as, owing to the falsely bedded nature of the strata in which it occurs, it is not continuous. In some of the surrounding shafts a similar band has not been met with, but the sandstone at its junction with the clay was found to be more ferruginous and hardened by partial opalisation into a "sandstone band," which also contains opal in the form of seams and pipes.

In Evans' claim, however, seventeen trial shafts have been put down at different points, and these all "bottomed" on the same formation, the bulk of which remains yet to be removed. The same formation has also been worked just outside his boundary, and is also found about 3 or 4 chains to the east, but in most other places the ordinary hardened sandstone band has been met with.

Owing to the characteristic tendency to opalisation of the sandstone, common opal is met with almost anywhere that a shaft is sunk, but the precious opal is by no means so plentiful. The opal-bearing band and ferruginous concretions being so much harder than the sandstone, their fragments are left on the surface after the surrounding rock has been denuded away, and the small pieces of opal they contain shining on the surface, give rise to the so-called "colours." Occasionally the origin of these can be traced to the outcropping band, but owing to the false bedding of the strata, the finding of the original outcrop is often very puzzling.

There are now nearly forty men on this field, the largest number which have yet been there at one time, and the chief activity is centered in the successful claim belonging to Mr. Evans. The most extensive working, however, has been done in the past on what is known as the Old Flat, which adjoins Evans' lease to the east. Several claims are in operation here, but no very regular mining is carried on. Men come and remain for a short time, working out the old pillars left by previous miners. The shafts are here of variable depth, some being as much as 24 feet, while on the eastern edge of the flat the band is close to the surface.

The workings cover the whole of this flat, which is about 5 or 6 acres in extent, and there is very little solid ground left. The other chief workings in the vicinity are those known as the Southern Cross Field, which is about half-a-mile east of the Great Extended. Opal was first found here in 1883, and the ground was subsequently taken up as a lease, and floated with others into a company by Mr. Bond. Work was carried on for several years, and one dividend said to have been paid, but soon after the death of the manager operations ceased.

Work has since been done, however, at intervals by various miners, who have obtained a good deal of opal.

About 4 miles S.S.W. of the Great Extended Mine there are some workings known as the 4-Mile, the shafts, &c., covering about three-quarters of an acre.

Only about £80 worth of the gem was obtained from here, the best of it being bought by Mr. Evans; and the mineral was in a sandstone band, no boulder or kernel opal being found.

Just to the east of this locality is another similar outcrop, and about an equal amount of work has been done.

About 4 miles south of the Great Extended Mine are some fissures in the Desert Sandstone filled with siliceous ironstone, which are believed by Mr. Evans to contain small quantities of gold, but this I think unlikely, and the mode of occurrence would not lead one to suspect a gold-bearing deposit.

The Koroit Opal Field is in the Cunnamulla Mineral District, and lies about 55 miles from Yowah, more exactly 48 miles in a direct line N.N.E. of Eulo, and the easiest means of access is from Cunnamulla direct. It is situated in an area of

Desert Sandstone, which extends in a north and south direction for at least 80 miles, and has a mean width of about 10 miles.

At the north-west corner of this area some of the upper beds of the Desert Sandstone still remain, forming what is known as Moriarty's Range. The occurrence of opal in this locality seems to have been first determined about 1897, when a syndicate was formed by the manager of an adjoining station to work the deposit.

Only a small quantity of opal was obtained, and early in 1900 a larger syndicate was formed, including most of the original members, when more extensive work was carried out at a greater depth. About £800 worth or £900 worth of gem stones is supposed to have been obtained, but this is little more than mere rumour.

During the period of greatest activity some twenty or thirty men were engaged on the field, but the scarcity of water, which in the dry season was carted 12 miles from the Paroo River, ultimately prevented further profitable work, and the place is now quite deserted.

Six miles from *Koroit*, in an easterly direction towards Bando, good prospects of opal have been obtained, but the bulk of that found so far has been of the glassy-blue variety, and valueless.

The Fiery Cross Field is just outside the boundary of the Paroo Mineral Field, and is situated 25 miles from Yowah in a north-westerly direction. It may best be reached from the latter place by following Yowah Creek as far as Dundoo Station, from which it lies 12 miles almost due west. This field is in a portion of the same area of Desert Sandstone as the Yowah Field, and the whole of the series has apparently a slight dip to the east, of probably less than 1 in 2,000. The workings are situated in a gorge, where the upper beds have been removed by denudation. There are a number of shafts sunk closely together over an area of about 2 acres, and they pass through a soft pink standstone, which no doubt corresponds to that at the Yowah Field. The shafts are from 10 to 15 feet deep, and after piercing the sandstone enter a rather siliceous clay. Here, as at Yowah, the opal was obtained chiefly at the junction, but in the hardened band at the base of the sandstone and not in kernel boulders.

The sandstone is here very soft and rotten; and, unlike Yowah, a considerable amount of timbering was necessary to support the roof.

All the work seems to have been confined to one area, and I am of opinion that more thorough prospecting of the locality—especially in the deeper ground—would be worth undertaking.

At the time of my visit the field was quite deserted, the few men who had been working there for some months having recently gone to the Duck Creek Field. The country in the vicinity is extremely barren, and the site of the old camps, in another gorge, is about a quarter of a mile distant near a spring or rock hole. Although a good deal of work was done, the quantity of opal obtained is not believed to have exceeded £1,000 in value.

The Duck Creek Opal Field is in the Paroo Mineral District, and lies about 40 miles towards the north from Yowah. It is also on Yowah Creek near its head, and is most easily accessible from Eulo by road, a distance of about 76 miles. It is situated on a low ridge, which separates those waters, which drain into Yowah Creek and thence to the Paroo River, from those which reach the same river more directly by Box and Beechal Creeks. The surface of the country is almost quite flat.

Some very extensive mining for opal has been done in this neighbourhood, and the prominent features consist of the main Duck Creek workings, the different portions of which are known as the "New Field" and the "Old Field" respectively. There are besides this a number of surrounding camps and localities where opal-mining is carried on, and for which the main camp at Duck Creek forms a kind of centre.

The New Field is not at present being very extensively worked. The shafts, which are deeper towards the northern and eastern boundary of the workings, have an average depth of about 14 feet, and pass through soft pink sandstone into hard grey or white clay. The hard ferruginous band or casing at the junction varies from a film up to several inches in thickness, and the underlying clay has also become extremely hard in many places, by partial or complete opalisation in its mass, it being then known as "flint band" by the miners. Precious opal is found in small clean pencil-like pieces or pipes near the base of the sandstone, in the band or casing, and in the clay. The junction of the sandstone and clay is not regular, but frequently takes dips and bends as though the overlying portion were laid down on an uneven surface. Colourless or common varieties of opal form the largest proportion of that obtained, and with this, though the mode of occurrence is the same, the forms are usually much larger and more massive. The methods of mining are very similar to those previously described, only the opal-bearing portion of the formation is left on the roof instead of the floor, and broken down for subsequent examination. After the shafts are sunk the miners put in drives or chambers by removing the clay for a sufficient depth to enable them to work in a crouching position, an operation known as "ky-outing," and the band is afterwards broken down from the roof for examination.

The Old Field is really a continuation of the workings previously described, as it adjoins them. It is, however, the oldest portion of the field, from which a very large quantity and some of the finest opal was obtained. Conditions are similar to those described at the new field, and the whole of this portion of the workings has been very thoroughly searched.

Though there is very little workable ground left, some splendid opal is found here yet, a good deal obtained by turning over and searching the old heaps and mullock—"noodling." A number of men often make a good living at this occupation, which is also indulged in by the children and women of opal camps.

Goodman's Flat is situated 2½ miles to the N.W. of Duck Creek. A number of shafts have been sunk here through a sandstone, beneath which is a hard white sinter-like material, probably a sandy clay hardened by partial opalisation. The precious opal was partly obtained from boulders at the base of the sandstone, and partly from the underlying rock called "cement" by the miners; but the total production has been limited to a few stones.

The One-mile Workings, east of Duck Creek Old Field, consist of several shafts from 15 to 40 feet deep, from which about £200 worth of opal is said to have been obtained.

Sheep Station Creek workings are situated at the head of Sheep Station Creek about 5 miles S.W. of Duck Creek. The credit of having discovered opal in this locality is given to Peter Nixon, a civilised black, who has been prospecting in the district for a great number of years.

At the portion of the workings where operations are now in progress, the shafts passed through 8 feet of pink sandstone, and there was then a bed of clay 3 feet in thickness, and another bed of sandstone whiter in colour. The latter has a thickness of 4 feet 6 inches, and has beneath it another clay bed. Opal was found in the "band" at the base of the upper bed of sandstone, in the clay, and also in the second bed of sandstone. Boulders occur in both beds of sandstone, and when in the lower one are termed "floaters." They can also be seen weathering out on the surface.

The portion of the workings where most of the opal was obtained originally is about 150 yards to the S.W., and the total value of it is estimated to have been £600. Some was of very fine quality, and was taken to be sold at the White Cliffs Opal Field in New South Wales.

The Emu Creek workings are situated 4 miles S.E. of Duck Creek, and the finding of the gem here is also attributed to Nixon. His discovery, however, of surface specimens was only made just prior to my visit, the camp being then known as the "New Rush." There was some excitement over the matter, and a number of shafts were being sunk, but none had reached bottom, though some were 25 feet deep. No doubt some gem stones have since been found here, but from reports which reached me I have reason to believe that results did not come up to expectations. Besides the localities already described, prospecting is carried on at intervals at *Johnson's Mine,* 15 miles distant, on Ardoch Station Run; and at the *Golgonda Mine,* about the same distance from Duck Creek, on Dundoo Run.

The Pride of the Hills Mine, in the Paroo Mineral District, is 12 miles N.W. of Duck Creek, or 13 miles east of Toompine. These workings are near the western margin of the large area of Desert Sandstone, in which are situated all the fields already described. Here the formation is seen in the form of ridges and spurs, and the workings are situated on the northern slope of one of these spurs. The upper beds, which remain as a capping, are from 15 feet to 20 feet in thickness.

A number of shafts have been sunk on the slope which passed through the sandstone at about 20 feet and entered the clay in which most of the opal was found. This clay contained a good deal of iron, and concretionary nodules or boulders were found in it. Masses of the clay have also become hardened and converted into a kind of semi-opal in a similar manner to that described at Duck Creek. The opal was nearly always found in the softer clay, but occasionally in the hard portions and also in the sandstone in the usual way. Owing to surface configurations, portions of the opal-bearing band are to be seen weathering out on the slope near the foot of the hill, and their presence, no doubt, gave rise to the discovery and opening up of the mine.

As is not unusual in such cases, a number of shafts were first sunk on the flat ground considerably below the level of these surface specimens. Very large quantities of the blue and colourless varieties of opal were found here, but the value of gem stones obtained has not exceeded £200 or £300.

The mine is difficult to work owing to the scarcity of water in the vicinity, and, in fact, can only be worked for a few months after rains. There were three men at work there in October, 1901, and they were depending for their water supply on a rock hole about 2 miles distant.

The Lushington Mines, also in the Paroo Mining District, is 6 miles north of the Pride of the Hills, and, like the latter, is situated on an outlier of the main area of Desert Sandstone. The first group of shafts met with are spread over about an acre, and 250 yards to the east are other similar workings. At the present time the locality is completely deserted, no work having been done for three or four months.

The field was first worked in 1893, and about fifteen was the highest number of men ever engaged there. Except just after rains the scarcity of water is almost a bar to mining operations, and, in order to continue work, at one time water was being carted from Toompine, a distance of over 9 miles.

The sandstone is soft and rotten, and the shafts having all fallen in could not be examined. The uppermost beds of the Desert Sandstone series have here a thickness of 35 feet. Opal was obtained from boulders and from sandstone casing or band, and the total value obtained was not more than £1,000.

The Bull's Creek Opal Field is situated 70 miles almost N.W. of Toompine, but the easiest means of access is from Adavale, via Gunnedorah, thence branching west through Niccavilla Station across

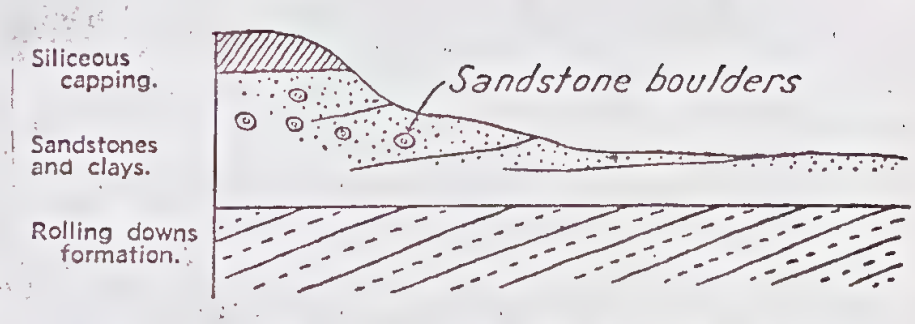
the Grey Ranges. This road distance would be about 94 miles. The field is situated in a large extent of poorly-watered country on the western slopes of the Grey Range, which is drained by Kyabra Creek.

The discovery of opal in the locality was probably made by the owners of "Ray," a neighbouring station, and its mining history appears to date from about 1885, when some boulder opal was obtained and sold for £40. For some time operations have been very limited, there being not more than three or four men engaged at one time, and the class of work being chiefly that of working out old pillars, &c. In October last there were only two men there who had just arrived, another party of miners having forsaken the field some weeks previously.

The conditions of mining and the occurrence of opal are here somewhat different to those previously described. The rock in which the mineral occurs though a sandstone of very similar variety is harder and has not been pierced by any of the shafts. The opal is found in large boulders called by the miners "sandstone boulders," which occur irregularly in the mass of the sandstone. They are spheroidal or ellipsoidal in shape, varying in size from a few inches upwards, and are of concretionary origin, apparently having been formed by an arrangement of the siliceous and ferruginous constituents of the rock in a series of shells. No nucleus is ever found, and they are either composed of the same material throughout, or the interior is a loose white sandy substance.

Opal is found in thin layers between successive shells of these boulders, or in somewhat larger veins and irregular masses filling joints and fissures therein. Opal is also found in thin seams or films in the joints of the rock. Another mode of occurrence of opal here is in what are known as "mud pipes" by the miners. These are pencil-like pieces of considerable length formed in the mass of sandstone, the silica being apparently derived from the rock itself immediately surrounding which has become soft and powdery for a radius of 2 or 3 inches. The soft stone is carefully scraped out with the ordinary scraper used for blasting purposes, and the pipe of opal thus obtained clean and undamaged.

The sandstone has been worked in search of boulders largely by open cuts, from which drives have been put in in all directions, from the surface down to about 18 to 20 feet. The upper portion of the sandstone being hard and compact often requires the use of explosives, and hence the field is not, as a rule, a profitable one. To the south and west of the workings, the hard white capping "top rock" remains covering the sandstone, and in this the silicified remains of trunks and branches of trees are frequently found. It seems probable that an opal-bearing band would be found at the base of the sandstone, and that trial shafts sunk deep enough to reach the underlying clay might yield profitable results.



Section of Opal-bearing Country at Bull's Creek.

The work which has been done at Bull's Creek is very considerable, and is distributed over an area of about 15 acres. That known as Huxley's claim was the richest, and perhaps the "Bona Venture" the largest.

The field is but poorly provided with permanent water, the supply of which is derived from a small spring, which fails when the dry season becomes at all prolonged; and on this account the deposit has several times been unworkable. It is said that the total value of the production lies between £2,000 and £3,000.

Prospecting has been carried on at *Bowra Creek*, 14 miles S.W.; and at *Moble Creek*, between Bull's Creek and Toompine. *Barry's Mine* is 2 or 3 miles to the east.

The Marble Arch Mine, about 7 miles N.E. of Bull's Creek, is said to have been first worked in 1883 by Batty and Gilbert. It is now deserted, but has been worked off and on since its discovery for a total production of about £1,000.

The Valdare Mine is 12 miles north of Bull's Creek, just over the boundary fence dividing Niccavilla Station and Ray. It is a very old mine, having been in existence nearly twenty years ago, and the first work was probably done by Cole and Harvey, who obtained boulder opal. The mine was afterwards worked by a syndicate consisting of the owner of Ray Station and several others, and called the Valdare Company. Labour was employed to work the mine. Operations were carried on for about two years, and appear to have resulted in the winning of a large quantity of opal, but the company ultimately had to cease work, and the last of the profits were absorbed in lawyer's expenses.

Opal was found chiefly in sandstone boulders, as at Bull's Creek, some of them being of very large size. and it may be remarked that boulders of this kind occur as large as 9 feet in length. The sandstone at the Valdare Mine is rather hard and compact, but can generally be worked with a gad and bar.

Like Bull's Creek, none of the workings are more than from 5 to 15 feet deep, and it is not improbable that deeper sinking would lead to profitable results. The cost, however, of sinking in the hard rock is rather more than the ordinary prospector can undertake.

Between Bull's Creek and the Valdare Mine are a number of smaller prospecting workings, of which the Boulder Mine is about 2 miles and the Sandstone

Mine about 1½ miles south of the Valdare, and probably £10 or £12 would represent their output.

The group of mines which are sometimes included under any of the general names of the Erounghoola, Keeroongooloo, or Kyabra Fields, though they are not in any declared mineral field, comprise some of the oldest mines. They are rather widely separated from any previously described, being much further west in the country draining into Cooper's Creek.

The Little Wonder Mine is situated 35 miles west of Erounghoola Station, or the township of Eromanga, which adjoins it, and is accessible by road either from Thargomindah or Charleville. This mine has been one of the richest of the opal mines. It was purchased from the discoverer for a small sum by J. Bridal, who was the original owner, and whose name has been always associated with it. In 1891 it became, with other leases, the property of the South-western Queensland Opal Company, of which Bridal was a member. At one time 50 men worked and lived at the Little Wonder, but its total production cannot be estimated. The original owner, however, obtained £14,000 worth of opal from the mine. The deposit is on the western slope of what is known as McGregor's Range. The country is drained by Bargero and Cunnavalla Creeks, but the supply of water for domestic purposes is derived from some of the old shafts which have been filled during rains.

The opal was here chiefly found at the base of a bed of sandstone, there being a bed of hardened clay beneath it, and both are apparently at a higher level in the series than those previously described. The ferruginous casing is very hard and has an average thickness of about 2 inches, but it may widen out or become a mere film. The clay is of a light brownish colour, in some places hardened so as to be almost porcellanised, and the labour of removing it is very considerable. This hardening generally occurs in the upper portion of the clay for a depth of about 2 feet 6 inches, the lower portion near the floor of the drives being generally of a soft grey variety. There is generally a thin stratum of ferruginous material separating them.

The total thickness of the bed of sandstone is here about 20 feet, and of the uppermost beds of the series, which are seen on the hills to the south, about 35 feet. The surface is also covered by the same intensely hard débris of siliceous rock, and the whole of the capping is of similar composition to that described elsewhere. Fine examples of the remarkable weathering of this rock, which must be extremely rapid, are to be seen in the vicinity. There are very few shafts, the method of exploring the junction of the sandstone and clay being universally by tunnels. The workings are very extensive, the drives being widened out and extended irregularly in all directions, and the whole of the end and eastern side of the ridge on which they are situated has been almost completely worked out. Two men are working here at present exploring or prospecting the south-eastern extremity of the workings, but the deposit is supposed to have been worked out and for some years has been practically deserted. The country immediately surrounding has naturally been fairly well prospected, and a number of other deposits located which have been worked at different times.

The Yellow Nell, so called from the colour of the sandstone, is about 3½ miles to the east, on the road from Erounghoola Station; and the *Pinnacles Mine* is about 7 miles from the Little Wonder, also close to the road.

Pott's Mine is about 10 miles towards the south-east, and *Laman's Mine* about 12 miles from the Little Wonder in the same direction. Both are on Mount Margaret Run, and are "sandstone boulder" mines, and neither is at present being worked. The production of the former was about £3,000 in value, and of the latter, where the opal was not of such good quality, about £300.

The Old Cunnavalla Mine is situated about 8 miles north of the Little Wonder, and is also rather celebrated amongst opal mines. Its history dates from about 1888, when, under the name of "Mascotte II.," it formed, with the Southern Cross at the Yowah Opal Field, one of twelve leases which were floated into a company by Mr. Bond. The opal was obtained almost exclusively from sandstone boulders, and there appears to be no doubt that the mine was a rich one, but the amount of its output cannot now be estimated. At the period of its most successful working, about 1891, it supported a considerable number of miners, but the locality has gradually become totally deserted, on account of the unfavourable conditions for grass and water which have prevailed for so long.

The Quart-pot Creek Field is 16 miles from Erounghoola or Eromanga, approximately north-west, and may be reached by following the Kyabra telephone line until it crosses Quart-pot Creek. The workings are about half-a-mile west of the dam at this crossing, and are, comparatively speaking, of recent origin. The main camp is situated close to the dam near the head of Quart-pot Creek, but this, though it provides good water for about two months after rains, is by no means a permanent supply. This field is also situated on the margin of the area of Desert Sandstone known as the McGregor Range, and the plains of the Rolling Downs Formation are to be seen about 1½ miles to the east; but the slope from one to the other is so gradual that a difference of level is almost difficult to detect.

There are in all about twelve shafts varying from 10 to 15 feet in depth, and in places the sandstone shows well-marked lines of stratification.

The opal was chiefly obtained in sandstone boulders, some of which were of considerable size and contained very massive common opal, generally on the lower side and sometimes in irregular veins ½-inch in thickness. Some precious opal was obtained in a similar manner, though in veins of much smaller dimensions. Common opal was also

obtained from a band at the base of the sandstone in the usual manner. In one shaft where the common variety of opal was found in this way deposited as pipes or veins, those round the outside edge had a black margin or casing, the constituents of which were chiefly silica, oxide of manganese, and oxide of iron. The total value of the opal obtained here is supposed to be about £150.

Mulcahy's Mine, which is the oldest in the district, is about 3 miles south, and is being worked by two men, and 3 miles west of Quart-pot Creek there are also two men at work, but so far not very much has been done.

The eight mines just described, with the exception of Laman's Mine and Pott's Mine, are all situated on Yerounghoola Run, which is portion of the Kyabra Lease, and hence are often referred to as the Kyabra Opal Fields.

The following deposits are all on Keerongoola Run, and are generally worked from main camps which are situated at the most reliable waterholes:—

The Mascotte Mine is about 14 miles in a direct line from the Quart-pot Creek camp, or 30 miles N.W. of Eromanga from which it is accessible by road in a distance of 38 miles, and it is situated on another of the twelve leases which formed the property of the company previously mentioned. Boulder opal was exclusively sought, and no shafts were ever attempted. After the company ceased operations the lease was abandoned, except by occasional fossickers, until early in 1901, when three men sank a shaft and opened out on the junction of the sandstone and clay. This is known as Chippendale's Shaft, and is the deepest opal shaft which has been worked; the lowest portions of the workings being 65 feet below the surface. The shaft passes through coarse yellow sandstone for 45 feet, and then into a compact clay, a considerable amount of opening out having been done at the junction. This junction is very uneven, and has apparently been cut at the nearest point to the surface, as each of the drives dip away from the shaft at about 1 in 3 or 1 in 4. The dark-coloured casing of siliceous ironstone is found as usual varying here from 1 inch to 2 inches in thickness, and the sandstone immediately above it for a distance of from 6 inches up to 2 feet is full of nodules and lumps of clay. The mass has a conglomerate-like appearance, and is called by the miners "Mottled Sandstone," or often "Cuckoo Sandstone." The underlying clay is stained by oxide of iron, and is very similar, though not so hard, as that at the Little Wonder Mine. It often contains pipe-like concretions, which are sometimes solid, or have a core of common opal. Opal also occurs in the ironstone casing, but more particularly just above it in the mottled sandstone, where common opal and opal that is not quite saleable is very plentiful.

The amount of precious opal obtained so far has not been very large. The old boulder workings of the Mascotte Mine are about 5 chains N.W. of this shaft, and occasional stones are still found there. The total amount of precious opal obtained from this locality has probably not exceeded £150 in value.

The Gladstone Mine, about 1 mile to the east, is on the slope of a small circular hill, and the workings are in the upper portion of the same bed of sandstone as those of the Mascotte Mine. The value of the opal obtained was £700.

The Gem Mine, 2 miles N.E. of the Mascotte, and another of the leases originally held by the South-western Queensland Opal Company, was worked entirely for sandstone boulder, and is said to have been a rich deposit. The workings are extensive and closely crowded, covering about 1½ acres.

Malone's Mine is about three-quartrs of a mile north of the Mascotte Mine.

Peppin and Webber's Mine is another well-known deposit, and is about 1½ miles N.N.W. of the Mascotte. It flourished about the same time as the Little Wonder and Cunnavalla, and, like the latter, is now entirely deserted. It is thought by a number of the opal-miners that further quantities of opal would be obtained from it if it could be worked, but on account of the extremely rotten nature of the sandstone rather extensive timbering is necessary, which is beyond their means.

The workings are round the southern point of a ridge, and the opal-bearing band exposed by denudation was evidently found at the toe of the slope, and followed in towards the deep ground until the over-burden became excessive. Workings were then started a little higher up the hill, large square pits being put down, and from these pits tunnels and drives, which must have been many hundred feet in extent, were put in along the junction of the sandstone and clay in all directions. There was generally a small cutting to allow the mullock to be brought from the drives to the surface, and the object of this method of working was apparently to enable the drives to be commenced in more solid rock, which had not been so much affected by weather.

In one place there were eight drives leading from one of these pits, but except in one or two instances they were all in a condition too dangerous to explore. The same hard casing is present in the base of the sandstone, which is of a soft yellow variety with vertical fissures and joints runnng in all directions, and the bed is about 20 feet thick. Above it on the crown of the ridge is a bed of porcellanite about 25 feet thick. This mine is supposed to have been discovered by a half-caste prospector, and was owned by Messrs. Peppin and Webber, proprietors of the original Kyabra leases. Labour was employed at first, but it was afterwards worked under a kind of tribute arrangement. It is not known how much opal was obtained from it, but it is generally believed amongst the miners of the district that the value of the production was about £9,000.

The last five mines are generally worked from a main camp near some waterholes known as Rossiter's Lagoons, but in October last this supply had given out and the camp was moved to a waterhole on Monkey Coolah Creek. There were six regular miners in the camp and two prospectors, and to the principal mine in operation the distance was over 4 miles.

The following mines are worked from a main camp known as the Gum Holes, which is situated about 5 miles N.E. of Rossiter's Lagoons, or may be reached direct from Eromanga in a distance of 35 miles.

The Scotchman Mine is 5 miles N.W. from the Gum Holes Camp, and the workings are situated round the eastern slope of an outlier of Desert Sandstone, the height of which is 150 feet. The beds are here arranged as follows:—The capping of the outlier is 35 feet in thickness, and beneath it 25 feet of yellow sandstone, very hard at the top of the bed; then a bed of yellow and white partially porcellanised clay and then softer sandstones and clays.

There are some short tunnels at the junction of the upper clay and overlying sandstone, but all the work is now carried on in an irregular manner by shallow digging in the talus round the slopes of the hill, where loose fragments of boulders and broken pieces of opal-bearing band-carrying precious opal are found in the débris. A considerable amount of this kind of mining has been done with fairly profitable results. It is probable that the broken pieces of band in the débris were derived from the sandstones underlying the upper bed of clay, which have never been properly prospected by means of shafts.

The Aladdin Mine is situated on an outlier 400 or 500 yards to the east, which originally formed part of the Scotchman Hill. The slopes are covered by talus and large masses which have slipped to a considerably lower level, and still retained the beds in their relative positions. The opal was found in the débris, and in opal-bearing boulders *in situ*. The Aladdin is one of the oldest mines, and work here is interesting as marking the beginning of activity in the opal industry. A company was floated in London by Mr. Bond for £2,500, in which this mine was the first holding under a freehold grant. It might be mentioned that this freehold is under "*The Mineral Lands Act of* 1872," and comprises 40 acres.

The story regarding the mine is that the opal-bearing boulders were removed without being broken, being then loaded into a large tank, and carted away either as exhibits or for the purpose of obtaining the opal by cutting with better appliances. Hence the statement sometimes made that a wagon load of opal was obtained there.

Mat's Hard Mine is about 2 miles north of the Gum Holes Camp, and the occurrence of opal there is somewhat different, the gem being found in thin veins in a small bed of porcellanised clay near the top of the series, and on account of its hardness and the hardness of the sandstone very little attempt is made to work it. Explosives were tried, but owing to their shattering action any opal in the rock was generally destroyed. The gems obtained were of very good quality, and about £150 worth are all that have been got from the mine.

The Two Jack's Mine is three-quarters of a mile east of Mat's Hard Mine, at a considerably lower level. Nothing more than a little very imperfect prospecting was done here, and though a great deal of common opal was obtained in a sandstone band, only one or two pieces were good enough to sell.

The Hen's Nest Mine, about 1½ miles further west, has been worked to about the same extent, and with about the same result. It might be mentioned that *kernel boulders* are found here occurring in nests at the junction of a small bed of porcellanised clay and the sandstone beneath it. None, however, have been found perfect, the kernel being either only partially filled or the opal being mixed with ferruginous material.

Hammond's Mine is in a gully about a quarter of a mile further south, and opal was chiefly obtained from boulders in the softer sandstone beds at a lower level. The deposit was discovered by the owners of Hammond Downs Station, and is a very old one, supposed to have been very rich.

McGeorge's Mine is about 1½ miles from the main camp, situated under some high cliffs where the country is thickly timbered with mulga, and is difficult to find without a guide. A little boulder opal and sandstone opal was found here, but prospecting has been very inadequate, and only a small quantity of valuable mineral can have been obtained.

The Scotchman, Aladdin, and other mines described, within a radius of 5 or 6 miles, are all worked from the only water supply—the Gum Holes—and are tried on and off by the same group of miners who carry their windlass, barrel, and mining-tools from one to another.

In October last there was about three months' supply of water at this camp, and the horses were grazing 7 or 8 miles distant and returning every day or two for water.

The Stoney Creek Camp is 5 miles north and a little west of the Gum Holes.

The Stoney Creek Mine was one of the properties held by the South-western Queensland Opal Company. The workings are situated on a large flat, the opal having been obtained under the sandstone at a depth of about 8 feet. All the shafts are now "mullocked" up, and being full of water could not be examined. The water supply for the main camp, which is situated on the edge of the workings, is derived from these shafts.

The area of ground worked is about 2 acres in extent, but all the valuable opal was apparently obtained from a very small area. The mine was

worked for some considerable time by the company, and must have been rich, as men were afterwards put on to turn over and re-examine the old mullock heaps.

Reliable information with regard to the output cannot be obtained, but there is no doubt that it must have been worth a good many thousand pounds, and comparable perhaps with that of the Little Wonder and Cunnavalla Mines. No work is carried on there now, owing partly to the fact that the flood-waters of Stoney Creek were turned into the old shafts by the miners, and this for a number of years has formed the most unfailing supply of water in the district.

De Lazra's Mine is really part of the Stoney Creek Mine, and lies about a quarter of a mile to the S.W. It is named after the fortunate Italian who found most of the gem stones. Some of the workings are here at a higher level than those of Stoney Creek, being situated on the S.E. slope of a circular hill, but the largest quantity of opal was found on the eastern side of this hill, in shafts sunk to a depth of from 8 to 30 feet. The sinking was easy, but the underlying clay very compact, and the sandstone contained quantities of gypsum in beds from ¼-inch up to 6 inches in thickness.

The workings cover an area of about 2 acres, and the value of the opal won was between £6,000 and £7,000.

The Bung Bung Mine is about 2 miles N.W. of Stoney Creek, and was also worked by an opal company. It is said to have been sold to this company in 1891 by the discoverer for £300, and it proved to be a valuable mine.

The output has been variously stated at from £8,000 to £10,000. The workings vary greatly in depth, 40 feet being the deepest, but the bulk of the opal was obtained at a depth of about 20 feet.

The mine was abandoned for a considerable time and the shafts filled with mullock, but some men are now engaged in cleaning out the old drives from which the bulk of the opal was obtained, with the intention of working out some of the pillars and solid ground which was left by previous workers.

The Gap Mine lies about half-a-mile east of the Bung Bung, and the workings consist of a few shallow shafts. Close to this deposit is another occurrence of *kernel boulders*, which, however, are subject to the same deficiencies as those at the Hen's Nest Mine.

The Union Mine is 3 miles from Stoney Creek, and is said to have produced £200 or £300 worth of opal. There are also all within a radius of a few miles workings known as the Scotch Lass, tho Last Chance, and Fort Hill, from all of which occasional stones are obtained by prospectors.

The Exhibition Mine is 6 miles west of Stoney Creek. Precious opal was first found here fourteen or fifteen years ago, the original prospector or discoverer being probably E. Bourke, and after being abandoned by him it was taken up by the South-western Queensland Opal Company in 1889. The actual value of opal obtained by the company before they ceased operations must have been several thousand pounds.

Opal, occurring in rather an unusual manner, was recently discovered here by the original owner, who returned to work the mine in September, 1901. The original workings are situated on the slope of a hill, the top of which is composed of a bed of hard sandstone about 12 feet thick, and immediately beneath it is a bed of extremely compact clay about 7 feet thick. This clay, which is stained by oxide of iron, contains a little magnesia, and its fractured surface has a rather greasy feel.

Precious opal of very good quality is now found occurring in the mass of this clay in small irregular-shaped, pea-like segregations as large as a quarter of an inch in diameter, thus—

Opal in Clay—Exhibition Mine.

occurring, perhaps, as frequently as three or four to the cubic yard.

The mine is unfortunately very badly placed for water, &c., the nearest supply being at present in the old shafts at Stoney Creek, 6 miles distant. It was in October last being worked by one man, who walked this distance twice daily carrying with him necessary water and provisions.

The next main camp is that known as the Fish Ponds, and derives its name from the dam on Keeroonghoola Run, which as a water supply is the ultimate resource of the miners in the district, though by no means absolutely permanent. There are no camps actually round this dam, but several of the mines obtain water therefrom by carting, and it forms a convenient base from which to reach any of them. The dam is situated about 13 miles N.W. of the Gum Holes, and 24 miles south of Keeroonghoola Station.

The Friday Mine is 7 miles N.W. of the Fish Ponds Dam, and is situated in what is known as Friday Creek or Friday Gully, but, like many other so-called creeks in the district, it is difficult to distinguish any fall in the country or anything to mark its course.

The opal is found in a sandstone band, and mining operations are almost entirely carried on by open surface works along an opal-bearing sandstone band, where owing to the false bedding of the strata

it crops out at the surface, having a strike approximately N.W. and S.E., and a dip of about 10 degrees. A number of shafts have been sunk at the back of the outcrop up to a depth of 15 feet, but nearly all the opal was obtained at the shallow depth of 4 or 5 feet, and the value of the total production is supposed to have been about £1,000.

There is generally a small camp here on account of the supply of water which is obtainable from the shafts.

The Breakfast Creek Mines are 6 miles N.N.W. of the Friday Mine, but there being no available water they have been abandoned for the present. These mines were also one of the properties held by the South-western Queensland Opal Company in 1889. Some of the gems which were obtained from here were of the very finest quality, but unfortunately the locality is particularly affected by dry seasons, and there is said to be never more than a few months' supply of water. In fact, the same may be said of the whole of the N.W. portion of the Coleman Range, where the deposit is situated, and where there are several others which have yielded very fine opal.

At the present time none of this country can be prospected, and the minimum rainfall of only 2·5 inches was recorded last year (1900); the mean fall is 10 inches.

Coleman's Cave Mine is also in the same vicinity, and was worked for boulder opal, but the sandstone was hard, and it has been deserted for a good many years. These deposits were those referred to by Mr. Jack in the Geology of Queensland as being in the neighbourhood of Costello Creek.

Pitt's Mine is 1½ miles east of the Friday Mine, and is worked for sandstone opal. The clays are very solid, and contain in places small lenticular beds of soft sandstone or sandy clay in which good opal has sometimes been found.

The gems from here are of very good quality, and the total value obtained up to the present is about £120 worth. The men working there, however, were on the point of abandoning the mine in October last, the water supply having given out.

Hausington's Mine, or the Havelock Mine, is situated 5½ miles north of the Fish Ponds, or about 20 miles south of Keeroonghoola Station. Next to the Great Extended, at the Yowah Field, this mine is at present the most successful of the opal mines, and is owned and worked by Westhead and Party, in all four men.

The mine was first worked by Hausington, who had to leave on account of the drought, and the present owners began work in June, 1901. For the six months to the end of that year they obtained a little over £500 worth of opal, and the total production of the mine is said to be about £2,000. It is situated on the southern slope of a spur which runs in a N.E. to S.W. direction, and the country drains into Keeroonghoola or Costello Creek.

A great variety of different kinds of opal is obtained, some being of very good kind, but the mine is remarkable for the quantity of saleable opal yielded rather than the quality. The ridge or spur on which it is situated is of similar formation to the numbers of others already described, the capping of porcellanised clay being from 10 to 15 feet thick. The deposit has been worked by a tunnel driven at the junction of the sandstone beneath it with an underlying clay. The characters of the sandstone at the junction is precisely similar to that described at the Mascotte Mine, but the clay is not quite so hard and in places rather loose and sandy. The opal is found almost entirely in the clay, in these loose sandy patches, and both there and in the sandstone there is a strong tendency to the formation of concretions of siliceous iron, which contain opal. The clay also contains a little magnesia, and is somewhat damp and greasy to the touch. A good deal of driving was done before any opal was obtained. The tunnels and drives are very extensive, amounting in total length to fully 400 or 500 feet, and in contrast to most other opal mines this one has been much more efficiently and extensively worked.

I believe the greater success obtained here to be largely on this account, which tends to show that if the miners would combine their efforts for work on a more extensive scale more opal would be found.

Baker and Connell's Mine adjoins Hausington's on the south, and is worked by three men, who have put in about 100 feet of drives. So far, however, only very little saleable opal has been obtained.

Scanlan's Mine is about 6 chains to the N.E. of Hausington's; and the *Aurora Borealis Mine* about a quarter of a mile east, but the amount of opal obtained from either did not exceed £50 in value.

This group of workings, which are so close together on the junction of the same bed of sandstone and clay, and from only one of which any appreciable quantity of precious opal has been obtained, is a striking illustration of the patchy nature of the occurrence of the gem.

The main camp of from twelve to sixteen men is situated in the immediate vicinity of Hausington's Mine, and water is carted from Catho, a fine waterhole 5 miles to the N.E. on Keeroonghoola Creek.

Stanley's Mine is another very old deposit not far from this spot.

The Jundah Opal Field is 17 miles W.N.W. of Jundah township, but the nearest distance by road is by a roundabout route of 25 miles. This field is situated in the Opalton Mining District. Precious opal was being obtained at Jundah for some years before 1888, but the bulk of the work was done about 1898, when the drought was being severely felt elsewhere, but when, there happening to be feed for horses in the mining reserve of this district, there was an influx of men from other fields where conditions were less favourable.

In 1900 there are said to have been about 100 men on the field. Most of the work done here has been concentrated at two points which are known as the Old Field and the Black Mine, which adjoins it on the east. The workings are all on a large flat of soft sandstone country, and the composition of the strata is very similar to that described at the opal-fields further south. The workings vary from a few feet up to 30 or 40 feet in depth, the greatest thickness of strata being at the eastern end of the Old Field and at the Black Mine.

At the Old Field, often called the *Top Flat*, opal is found in the hardened base of the sandstone and in the clay, and the usual thickness of the ferruginous casing of siliceous ironstone which separates them is about a quarter of an inch. The base of the sandstone also contains, in many places, a large quantity of clay in lumps or nodules—the so-called mottled or "cuckoo" stone. The band here, of variable texture, is composed of angular fragments cemented by partial silicification, and it occasionally exhibits signs of bedding, which, seen in the section, show in the form of fine black lines like pencil marks, the colour being due to the presence of oxide of manganese. It is then known as "pencil band."

Precious opal is also found here in what are known as "brick pipes." These are of approximate cylindrical shape, and vary from ⅛ inch to 2 or 3 inches in diameter, and are often 5 or 6 feet in length. They are filled with a hard siliceous, clayey material, coloured by oxide of iron, which has very much the appearance of red brick. Common opal ramifies through them in all directions. These brick pipes very probably owe their origin to trunks and portions of trees which have become replaced by opalising solutions and fragments of the enclosing rock. Lenticular beds of gypsum also occur in the sandstone and clay.

Boulders are to be seen in the overlying sandstone, but as far as I could learn very little precious opal was ever obtained from them.

The Black Mine is about half-a-mile to the east of the Old Flat, and conditions are here very similar, though the mining is somewhat deeper. The same brick pipes occur here, and they are sometimes found passing out of the sandstone into the clay beneath. Sometimes also the opal is found in veins in the band surrounded by a black casing or margin coloured by oxide of manganese, and similar to that at Quart-pot Creek. These workings are of very considerable extent, and the shafts and mullock heaps are scattered over 8 or 10 acres.

The Old Field was getting worked out, and the Black Mine, which has since been the principal producer, began to be worked in 1893. As far as is known, the largest find of opal of about £3,000 in value was made in 1899 at the eastern end of the Old Flat. The production of the field for 1901 is estimated to be nearly £1,300, and this is exclusively from the Black Mine workings, and includes £800 from a number of shafts on that portion known as Johnson's Claim. The gem stones obtained here are certainly of very fine quality.

The existence of a fairly large camp on this field for a number of years—a fact, however, partly due to there being generally grass and water for horses within reasonable distance on the mining reserve—is evidence in favour of its permanency as a centre of opal-mining. The want of water for ordinary use is nevertheless keenly felt; and, owing to the great distance west of the railway terminus, the price of rations is very high. The water for drinking is now derived partly from a small spring 3½ miles to the S.E. by carting, and partly from the "Gibber Holes," 11 miles distant, and it is only the fact of there being horse feed within a reasonable distance that enables this carting to be done. There is also a supply of water used for washing, &c., obtained from the old shafts, but this contains too high a percentage of the salts of lime and magnesia for drinking.

There are generally from fifteen to twenty-five miners in the camp, and also women and children.

Mick's Mine is 11 miles west of the Jundah Field, and is supposed to have yielded £170 worth of opal; and *Tomkin's Mine*, 8 miles, £150 worth. *The Tommy Dod Mine* is about 13 miles west of the Jundah Field, *The Magic Mine* 30 miles N.W., and *Dyson's Mine* 5 miles S.E.

There are also some prospecting operations in progress about 50 miles E.N.E. of Jundah on the Johnstone Range, between Swan Vale and Mount Marlow.

The Opalton Field often called the Fermoy Field, is about 100 miles further north. The nearest railway terminus is Winton, from which the field is situated in a direct line 60 miles S.S.W., but it is almost just as easily reached from Longreach. This field is also in the Opalton Mining District, on Warnambool Downs Run, the mean rainfall being 12 inches, and the minimum 3·5 inches.

The Opalton deposit, which was one of the largest and most exensively worked in Queensland, was discovered in 1888, probably by some stockman of Warnambool Downs finding opal on the surface. The gem, however, was found before this date at Horse Creek, some 28 miles to the south-west, which deposit was being worked in 1888.

No opal-mining of any importance was done at Opalton until 1893, when some specimens were brought to Fermoy Station, and a man named McLenan went out and commenced operations at what is known as the "Brilliant Claim." As a result of this first activity about £800 worth of opal was obtained. Other finds were made, and Conway's Claim was discovered in 1895, and a small rush took place. In 1896 there are said to have been between 500 and 600 men on the field. The rush was partly due to the good seasons prevailing, and with abundance of horse feed and water available, the township was in a flourishing condition.

The value of the total production is a matter which can only be guessed at, but it would not be very far from the mark to say that it must have been at least £30,000 or £40,000. The field, however, is now practically abandoned, and, save for a few old residents, the towship is deserted.

The police have been recalled, and there are not more than eight or ten miners living at the old camp. A good many of them are engaged in searching the old mullock heaps for stray stones. There are several outlying prospecting camps for which Opalton still forms a centre, but the whole number of miners engaged in the district is only about forty-five.

The topography of this field is very similar to that of Jundah, and the shafts, which are of about the same average depth, were sunk through a similar soft sandstone to the clay beneath. Boulders are found in the sandstone, and weathering out on the surface. The greater proportion of opal was won here from the old flats just to the east of the township, where the workings or mullock heaps cover from 60 to 70 acres, and different portions of these flats are known by various names of local significance. One of the richest claims was probably that known as the "Little Wonder," and the flat in this vicinity for 8 or 10 acres is practically all worked out. The Little Wonder Claim yielded opal to the value of £4,000.

Most of the mineral at Opalton occurred in the ordinary sandstone band, but the "brick pipes" and "pencil band" of the Jundah Field were also found. Numbers of other claims lie to the east of the Little Wonder, amongst others the Brilliant, from which the first gems were won.

Conway's Claim is about a mile from the old flat towards the east and south, and was a very rich deposit. Nearly all the mineral was found in one claim, which is now surrounded by shafts which extend over nearly 3 acres.

The Bald Knob Workings are about 4 miles east of Opalton, and at present two men are engaged there. A good deal of work was done here some years ago for an output of £1,000 worth of opal. A great deal of common opal or "schnide" was also obtained, some of it, though opaque and cloudy, being of very fine appearance. A parcel of it is said to have been sold and sent to Germany for making beads.

The Opalton miners have all been following the occupation for a number of years, and most of them are provided with a lapidary's wheel, wherewith they cut and polish their gems. The field is dependent for its water supply on the waterholes of a small creek which drains into Blue Bush Creek, a tributary of Vergemont Creek, the waters of which flow to the Thompson River. The supply from these holes is very poor, having at different times completely given out, and water has been carted as much as 14 miles.

A number of Opalton miners recently determined to examine the country to the south of Opalton, and for this purpose moved their camps to a place called Mayneside, an old out-station where there is a large waterhole, and where they intend to work in the vicinity of Horse Creek and Hyde Park Creek. Not much had been accomplished up to the beginning of December last, but it was hoped that with the season of storms approaching they would be able to operate in a number of localities where work was carried on some years ago.

The Horse Creek Mines are 25 miles south of Opalton in a direct line, Horse Creek being a tributary of Hyde Park Creek, which runs into the Mayne River, ultimately to the Diamantina. As already stated, this is the locality where opal was first discovered in this district, probably the oldest mine being that known as Cragg's Mine, worked in 1888. The Poison Mine, Carlyle's Mine, and several others in the vicinity of New Year's Creek are about 7 miles further south.

The waterhole at Mayneside forms a convenient base from which these may be reached, and where there were from fifteen to twenty men camping in December last.

The Kynuna Field is in the Windsor Mining District, 18 miles south of Kynuna township, or about the same distance west of the New Dagworth Station, and is accessible by road from Winton, the nearest railway terminus. It is situated on an area of Desert Sandstone lying between the heads of Cadell Creek and Crescent Creek, the country being drained by the latter. At the present time (January, 1902) the field is quite deserted on account of the scarcity of water, the nearest supply being that of Dagworth No. 1 Bore, about 10 miles distant. Several miners were working the field at the end of 1901, but had to abandon it, leaving their drays, tools, and appliances until rains enable them to return. The field was discovered about the year 1894 by Peter Karff, a prospector of the district. Karff's claim was afterwards sold to the owner of Dagworth Station, who floated a company to work it, but their operations did not meet with very great success. The total production from this deposit since its discovery is supposed to be about £3,000, and that for the past year is estimated at about £50.

The composition of the strata is here similar to that described at Opalton and Jundah, the siliceous capping of the surrounding hills having a thickness of from 20 feet to 30 feet. A fine typical example of the occurrence of this rock is to be seen between the opal-fields and Dagworth, where the capping remains like a castle on the apex of Pinnacle Hill.

The shafts at the Kynuna Field are, as a rule, quite shallow, but there are two or three which are from 20 to 30 feet deep.

The field has never been very extensively worked. The chief workings are those known as the Company's Claim, Macpherson's Claim, and Stuart's Claim. There is also a claim known as Hudson's, which is the most westerly of the workings, and which was worked for boulder opal, boulders being very numerous, weathering out on the slopes of the spurs in the upper portion of the sandstone.

Opal from the other claims was all obtained in the usual way from a hardened sandstone band, which had the characteristics of that found at Jundah. A little prospecting has also been done on the Desert Sandstone ranges, about 3 miles south of the new Dagworth Station, but though a good deal of common opal was obtained, not more than perhaps one or two small gem stones. There are some surface workings and also a few shallow shafts, sandstone opal being sought for.

The so-called "red brick pipes" of Jundah are also found, and in some cases here portion of the original tree structure can still be seen, thus furnishing an interesting example of their derivation.

The Springsure Opal Deposit.

The Springsure Opal Deposit is situated about three-quarters of a mile S.W. of Springsure, which is the terminus of a small branch railway running from Emerald on the Central Railway. Springsure is situated about centrally in a small area of basaltic rock, which is shown on the State geological map to extend in a N.W. and S.E. direction for about 45 miles, and to have a mean width of about 16 miles.

The deposit of precious opal here is interesting, as being entirely different from those previously described, the opal being found as amygdaloids in a vesicular basalt or trachyte. Moreover, the deposit is also interesting as being the only occurrence known in Queensland where the gem is found under similar geological conditions as in other parts of the world—i.e., the famous Hungarian mines, where it occurs in an amygdaloidal andesite, and the Mexican mines, where it is found in a similar manner in a porphyritic rock. The Hungarian mines are situated at Dubrick and Cservenicza, on the eastern slope of the Labanka Mountains, the workings and waste heaps stretching for nearly 1½ miles. While the Mexican and Honduras stones, which are beautiful when new, but soon lose their beauty, are found at Esperanza, Amaeleo, and Real del Monte. Opal occurring in a somewhat similar manner is found in New South Wales near Rocky Bridge Creek, and in several other parts of Australia. Valueless varieties of opal and hyalite in basalt are of common occurrence.

The opal-field at Springsure was probably first discovered in 1872 by O'Brien, an employee of Hinton Bros., storekeepers at Springsure. It was afterwards held under a lease by F. Batho, the officer in charge of telegraphs there, at a rental of £18 per year. This lease expired in 1896, and since then work has only been done spasmodically by casual prospectors. Batho is supposed to have sold gem stones from here on two occasions in London, in 1879 and 1886, and a gem sold in 1886 is said to have fetched £150. It is believed by some that this stone really came from Rainworth, near Wheeler's selection some miles distant.

The main deposit near the township is situated close to the Tambo road, at the top of a spur which runs in a S.W. and N.E. direction. The height of this spur is about 230 feet, it being composed of lavas and tuffs, and the opal is found in the more acidic lava which forms the capping, the volcanic focus of which was probably Mount Boorambool, which lies just to the north. The trachyte contains in many places large numbers of vesicular cavities, small thin veins and cracks, &c., filled with the different varieties of opal, which have been formed by infiltration of siliceous waters from the rock mass. The common forms are very plentiful, but occasionally the opal in the cavities is of the precious or noble variety, and gems so found are said to exhibit very brilliant colouring.

So far as prospecting has gone at present, they have been of rare occurrence, and though this opal rock is of very considerable extent, it is doubtful whether it would pay to work for opals commercially. As very little work has ever been done on the deposits, however, they seem to be worthy of further attention by prospectors, as it is possible that if the rock were properly opened up, the gems would be found to be of more frequent occurrence. The work done up to the present has been chiefly confined to breaking the loose pieces of rock on the surface.

There is another similar deposit of opal in the basalt about 9 miles from Springsure, close to the Taroom road. This deposit is about 300 yards from Wheeler's house, just over the boundary fence dividing Wheeler's selection from Rainworth Run.

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